Digistrip III

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DIGISTRIP III
USER'S GUIDE SUPPLEMENT

KAYE
INSTRUMENTS

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USER'S GUIDE SUPPLEMENT

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SECTION 1 - SPECIFICATIONS AND WARRANTY

1.1 Specifications

Dimensions:	Standard: 49.3cm wide x 31.1cm high x 51.4cm deep (19.0in. wide x 12.2in. high x 20.2in. deep) High Accuracy: 49.3cm wide x 31.1cm high x 57.7cm deep (19.0in. wide x 12.2in. high x 22.7in. deep)
Weight:	Standard: 28.2 Kg (62 lbs) High Accuracy: 31.8 Kg (70 lbs)
Input Voltage:	90-135 VAC (50/60 Hz), or 200-270 VAC (50/60)
Power Consumption:	60W (idling) 130W (printing)
Fuse:	1.5A Slo-Blo (90-135 VAC) 0.75A Slo-Blo (200-270 VAC)
Environmental:	0-50°C (32-125°F) Temperature Range 0-95% Relative Humidity (non-condensing)
Input Channel Capacity:	One, two or three 16-channel groups (maximum 48 channels) in basic instrument; expandable to 128 channels when used with remote scanner
Scanning Rate:	Eight channels per second in basic unit; higher effective rate when used with remote scanner
Input Impedance:	$>10^9\Omega$ after filter has settled. Source impedance should be $<2K\Omega$ for proper filter settling

Common Mode Rejection: (1KΩ Source Imbalance)	140db for DC 130db at line frequency 120db from line frequency to 100 KHz
Maximum Common Mode Voltage:	170 Volts peak (AC or DC) from channel to chassis ground and from channel to channel
Normal Mode Rejection:	60db (50/60 Hz)
Accuracy of Voltage Inputs:	±(0.003% reading + 1 count + 2μV) 30 days ±(0.006% reading + 1 count + 2μV) 1 year
Resolution:	1:65,535
Sensitivity:	0.5μV (on most sensitive range)
Voltage Temperature Coefficient:	±(0.001% reading + 0.1μV)/°C
Compensator Temperature Coefficient:	±0.02°C/°C
Temperature Non-Uniformity of Input Terminals:	Standard: ±0.3°C High Accuracy: ±0.05°C
Standard Functions:	Voltage Functions: 65mv, 650mv, 6.5V Thermocouple Functions: Types E,J,K,R,S,T (°C or °F, with internal ice point reference) Platinum RTD Functions: 100Ω in 1 ma current loop 100Ω in bridge configuration
User-Definable Functions:	32 linear functions 16 accumulation functions

Math Functions:	Interval average, interval maximum, interval minimum, change per minute, group average, group maximum, group minimum, transfer, square root, natural log, exponential, sine, cosine, tangent, inverse sine, inverse cosine, inverse tangent, addition, subtraction, multiplication, division, fourth order polynomial, compressible gas flow, relative humidity, equivalent sterilization time (ΔF), rolling average, rolling maximum and rolling minimum.
Special Order Option:	Deletes 0.01°C Type T thermocouple function and ΔF function; adds type N (Nicrosil/Nisil) thermocouple function and a function to compute fill volume of horizontally mounted cylindrical and elliptical tanks.
Channel Skip:	Individually programmable
Assignable Limits:	Two per channel; independently assignable
Limit Types:	High, Low, Rate-of-Change
Relay Closures:	Two assignable relays; assigned by Odd or Even relay address. Option provides up to 48 additional relays.
Relay Contact Configuration:	Form 1C, normally energized or normally de-energized
Relay Contact Capacity:	4A; 250 VAC resistive load
Time Intervals:	Print Interval, External Transmission Interval and Math Interval - all independently assigned. Programmable range 1 to 19999 minutes. A defined Time Interval of zero causes the operation to occur every 10 seconds.
Printer Type:	5x7 dot matrix, bidirectional printing on 137 column pressure-sensitive fanfold paper; internal paper takeup tray.

Printed Headers:	Nine line programmable data field; 128 alphanumeric characters per line (8 character positions per column). Additional line provides date and column numbers.
Printed Data Capacity:	96,000 channel data printouts per 150 page paper pack
Serial Interface:	RS232C and 20ma TTY current loop (passive)
Serial Interface Connectors:	Screw terminals
Alarm Message Printout:	32 programmable alarm messages

1.2 Analog Input Range and Accuracy Specifications

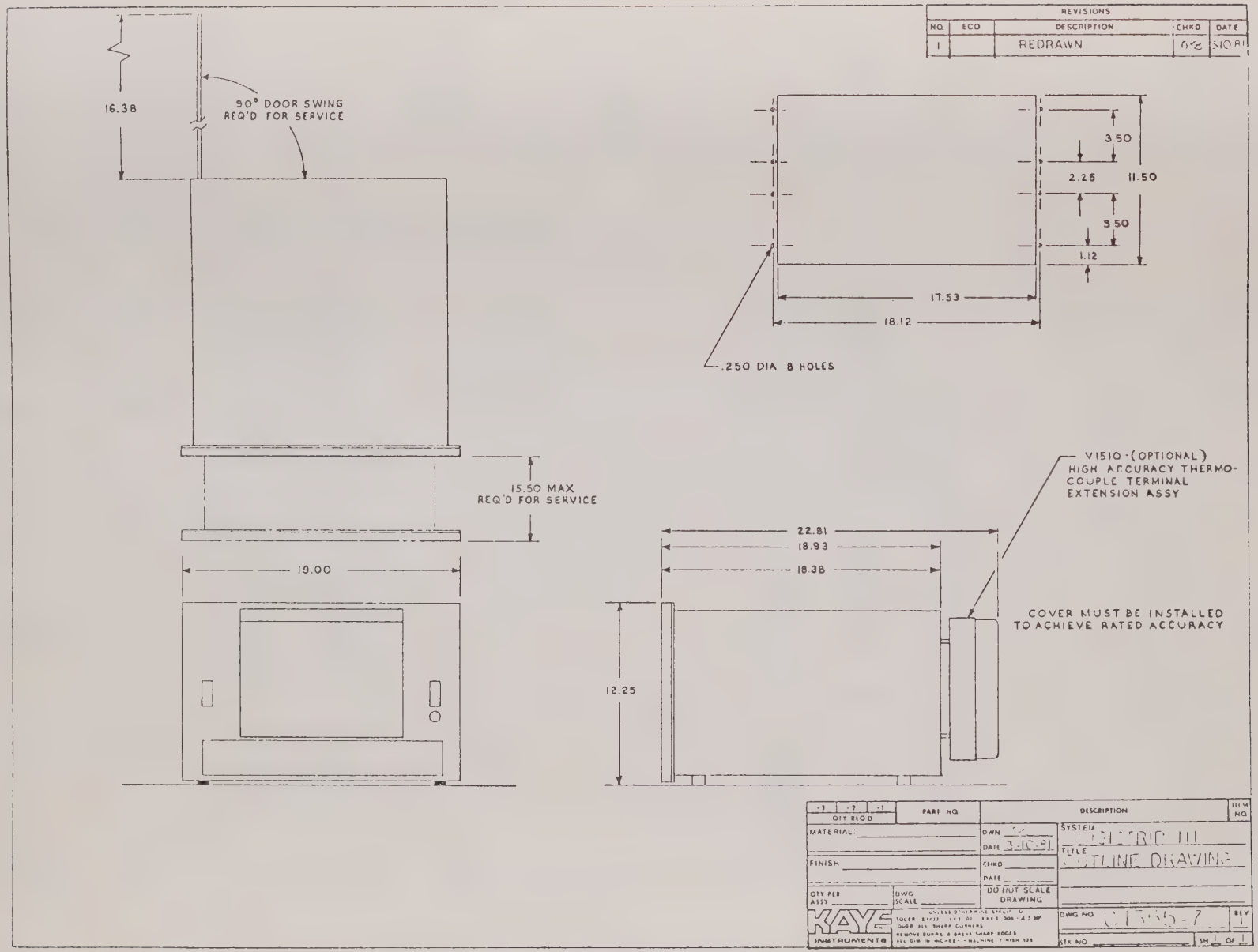
Input Types	Range	Conformity to NBS	Accuracy-Standard	Accuracy-High Accuracy
Voltage	32mv*, 65mv 650mv, 6500mv (6.5V)		±(0.003% reading+1 count + 2μV)	±(0.003% reading +1 count + 2μV)
Thermocouple, Type E	-109C to 858C (-164F to 1576F)	0.06C	±(0.003% reading+0.5C)	±(0.003% reading+0.25C)
Thermocouple, Type J	-112C to 1130C (-170F to 2066F)	0.06C	±(0.003% reading+0.5C)	±(0.003% reading+0.25C)
Thermocouple, Type K	-137C to 1392C (-215F to 2537F)	0.06C	±(0.003% reading+0.5C)	±(0.003% reading+0.25C)
Thermocouple, Type R	-21C to 1779C (-5F to 3234F)	0.1C above 260C 20.0C below 260C	±(0.003% reading+0.9C)**	±(0.003% reading+0.65C)**
Thermocouple, Type S	-21C to 1767C (-5F to 3212F)	0.1C above 260C 20.0C below 260C	±(0.003% reading+0.9C)**	±(0.003% reading+0.65C)**
Thermocouple, Type T	-220C to 402C (-364F to 755F)	0.06C	±(0.003% reading+0.5C)	±(0.003% reading+0.25C)
Thermocouple, Type T	-112C to 341C	0.02C	±(0.003% reading+0.45C)	±(0.003% reading+0.20C)
RTD, 100Ω Pt. 1ma	-128C to 855C (-198F to 1571F)	0.06C***	±(0.003% reading+0.1C)	±(0.003% reading+0.1C)
RTD, 100Ω Pt. bridge	-125C to 808C (-193F to 1487F)	0.06C***	±(0.003% reading+0.1C)	±(0.003% reading+0.1C)

* 32mv range used for Thermocouple Types R, S and T measurements only
** Accuracy specification for temperatures above 260C
*** Conformity to DIN43760

System accuracy includes all instrument errors including maximum conformity deviations, reference junction compensation with worst case thermal scatter of input terminals, long term drift, temperature coefficients, A/D conversion errors, and scanner errors. System accuracy, 30 days 20C to 30C ambient.

The AUTO CAL feature permits users to substantially improve the above listed accuracy figures by eliminating both sensor and system based thermal scatter effects.

1.3 Outline Drawing



1.4 Warranty

Kaye Instruments equipment is warranted free from manufacturing and material defects for a period of one year after delivery. Any equipment purchased from Kaye Instruments which becomes defective during this period will be repaired or replaced at the site of the customer or at the Kaye plant in Bedford, Massachusetts. The site of such repair shall be determined by Kaye Instruments. The only exception to this warranty is equipment such as a magnetic tape recorder, a paper tape punch, a computer or other equipment which is used in conjunction with a Kaye system, but is not a standard Kaye Instruments product. Such equipment will be warranted for a period of 30 days by Kaye Instruments if it is purchased from Kaye as part of a system. Warranty for a longer period may be provided by the manufacturer of the equipment.

Equipment returned to the Kaye plant for repair must have shipping charges prepaid and must be accompanied by documentation explaining the reason for return. Please obtain return authorization from Kaye's Service Department prior to returning any equipment for repair.

Kaye Instruments reserves the right to make changes or improvements in its products without incurring any obligation with respect to products previously manufactured. All warranties are contingent upon proper use in the application for which the products were intended and do not cover products which have been modified without Kaye Instruments' approval or which have been subjected to unusual physical or electrical stress.

Except for the express warranty set forth above, Kaye Instruments grants no warranties, either expressed or implied, on products, and the stated express warranty is in lieu of all liabilities or obligations of Kaye Instruments for damages including, but not limited to, consequential damages occuring out of or in connection with the use or performance of Kaye Instruments products.

SECTION 2 - CALIBRATION

2.1 Introduction

All Digistrip III process monitors are fully calibrated by Kaye Instruments prior to shipment. These instruments normally need no further adjustment or calibration at the time of initial installation. To assure continued accuracy, however, certain adjustments must be made periodically.

Under normal operating conditions, each Digistrip III should be checked-out and recalibrated at least once each year. When high accuracy measurements are being made, more frequent calibration may be required. In addition, recalibration is sometimes required when instrument service is performed (e.g. replacement or addition of a circuit board, etc.)

Complete calibration of a Digistrip III involves three basic operations; these operations are:

- Analog Board Calibration
- Zero Width Adjustment
- Reference RTD Calibration

2.2 Analog Board Calibration

The Digistrip III's Analog circuit board (part #U0920) acts as a digital voltmeter. This board is mounted inside of the cabinet rear door.

All Analog boards are calibrated by Kaye Instruments prior to shipment; these boards normally require no further calibration at the time of initial installation. Analog boards in existing Digistrip III systems, however, should be calibrated at least once each year. Calibration of these boards should always be done before any other Digistrip III calibrations.

Materials Required

High quality, laboratory grade potentiometer or precision voltage source, such as EDC Model E100.

Phillips screwdriver

Small screwdriver

Calibration Procedure

1. With the instrument power switched ON, remove the four rear door securing screws and open the Digistrip III's rear door. With the rear door open, the Analog board will be visible behind a black metal heat shield on the rear bulkhead.

2. Note the positions of potentiometers P1-P5 along the right edge of the Analog board; the calibrating adjustments will be made using these potentiometers.

3. When familiar with the positions of P1-P5, close the rear door and allow the instrument to temperature stabilize. Temperature stabilization usually takes approximately 30-45 minutes from power ON.

4. Hook-up the precision voltage source to the input connectors of an appropriate channel (e.g. channel 101).

5. Once the Digistrip III has temperature stabilized, conduct adjustment steps 1-5 as described in the following table.

ANALOG BOARD CALIBRATION

Adjustment Step	Channel Function Assigned	Control to be Adjusted	Precision Input Voltage	Reading After Adjustment
1	03	P1	+6000.0mv	6000.0M (±0.3mv)
2	03	P2	-6000.0mv	-6000.0M (±0.3mv)
3	02	P3	+600.00mv	600.00M (±0.03mv)
4	01	P4	+60.000mv	60.000M (±0.006mv)
5	13	P5	+30.000mv	6.0000 (±0.0015mv)

Note: This table gives the order of adjustments, the function number required to set the DVM range, the name of the control to be adjusted, and the input voltage and required output readings. The calibration order is important because the first and second adjustments each directly affect all the adjustments which follow. Also, since thermal stability is important to the accuracy of this calibration, the rear door of the Digistrip III should be kept closed between potentiometer adjustments.

2.3 Zero Width Adjustment

The Zero Width adjustment of a Digistrip III is necessary because of electronic delays within the DVM. These delays result in minor inaccuracies in count values. The Zero Width varies from one analog board to another and must always be compensated for when making accurate measurements. Compensation for an analog board's Zero Width is made by the appropriate setting of the DIP switch slides on the Data Acquisition board.

The Zero Width compensating adjustment of all Digistrip III systems is made by Kaye Instruments at the time of manufacture. Since the Zero Width value of an analog board does not vary significantly, subsequent adjust is not normally required. Adjustment is required only if the analog board or data acquisition board is changed.

Note: The Zero Width adjustment is difficult to perform and should only be attempted by qualified service personnel.

Materials Required

A high quality, laboratory grade potentiometer or precision voltage source, such as the EDC Model E100.

Adjustment Procedure

1. Turn the Digistrip III power switch ON and define function 03 (6.5 V range) for channel 101.

2. Attach the lead wires from the precision voltage source to the channel 101 input terminals.

3. Open the Digistrip III's front door and slide the chassis forward. When doing this, take precautions to assure that the instrument does not tilt forward.

4. Using the Digistrip III's keyboard, call up channel 904 and note the value displayed (e.g. 2.3 mv).

   Note: Channel 904 has a shorted input. Its reading denotes the DVM's auto-zero offset value for the 6.5 V range.

5. Using the precision voltage source set on the millivolt range, apply the same voltage (both magnitude and sign) displayed for channel 904 to channel 101.

6. Call up channel 101 via the keyboard and note the value displayed.

7. Adjust the precision voltage source to add 1.0 mv to the original channel 101 input (e.g. 2.3 mv + 1.0 mv = 3.3 mv) and note the channel 101 value displayed.

8. Readjust the precision voltage source to subtract 1.0 mv from the original channel 101 input (e.g. 2.3 mv -1.0 mv = 1.3 mv) and note the channel 101 value displayed.

9. When the Zero Width is properly adjusted, the Zero Width span between the +1.0 mv and -1.0 mv displayed values should be 2.0 mv (e.g. 3.3 mv -1.3 mv = 2.0 mv. If the displayed span does not equal 2.0 mv, adjustments must be made via the data acquisition board's DIP switch slides #1-7.

10. The Zero Width span adjustment values of the DIP switch slides are cumulative. The values of the various slides are shown in the table below. To increase or decrease the Zero Width span, turn the appropriate slide(s) ON or OFF.

Slide Number	Zero Width Span Adjustment (Approximate mv Value)
1	5.12 mv
2	2.56 mv
3	1.28 mv
4	.64 mv
5	.32 mv
6	.16 mv
7	.08 mv

Note: Changing slide #7 may have little effect; it will change the span by less than 0.1 mv. Any DIP switch slide changed will affect the channel 904 reading by a value approximately equal to that of the slide changed.

11. Repeat steps 4-10 (above) as necessary to achieve a proper Zero Width setting.

2.4 Reference RTD Calibration

Each Digistrip III is equipped with either one, two or three Channel Access boards. These boards are mounted on the instrument's rear door. Each Channel Access board has a 100 ohm platinum RTD positioned inside its isothermal terminal block. Whenever a Digistrip III is used to process thermocouple inputs, the RTDs sense the temperature of the terminal block connectors and provide automatic ice point reference compensation.

All thermocouple reference RTDs are calibrated by Kaye Instruments prior to shipping. They normally require no further calibration upon receipt. Once operational, Digistrip III reference RTDs should be calibrated at least once each year. When high accuracy measurements are being made, more frequent calibration may be required.

Thermocouple reference RTDs normally are calibrated at the ice point, using a Kaye Model K140-4 Ice Point Reference (or crushed ice bath). The calibration procedure is described below.

Materials Required

- Kaye Model K140-4 Ice Point Reference, or a properly made crushed ice bath.*
- Phillips screwdriver
- Small regular screwdriver
- Thermocouple sensor hook-ups

*Preparing an Ice Bath

Material Required: Dewar (vacuum) flask.

Pure water (preferably distilled) for both ice and water.

1. Fill the Dewar flask with crushed or shaved ice. Fill the flask with pure water and allow it to cool to the ice point.

2. Decant some of the liquid from the flask and replace it with shaved or crushed ice. Repeat this procedure until the ice extends to the bottom of the flask. This can be checked by pressing on the top of the ice.

3. The melted water must be periodically drained and replaced with more ice. Failure to do this can result in an error of as much as 4°C, even though ice is still visible in the flask.

Calibration Procedure

1. Turn the Digistrip III's power switch ON and allow the instrument to temperature stabilize for approximately two hours before starting the calibration procedure. Keep the instrument's rear door closed during this period.

2. Prepare the ice point reference (or crushed ice bath) and position it in a convenient location for conducting the thermocouple calibration.

3. Hook up one type E, J, K or T thermocouple to the input terminals of a selected channel in each 16-channel group to be calibrated.

   Note: Thermocouple types R and S are not recommended for this calibration procedure because of their low output level in the ice point range.

4. Remove the retaining screws from the Digistrip's rear door panel (or high accuracy thermocouple input panel).

5. Using the Digistrip III's keyboard, define the appropriate thermocouple function for each test channel. The thermocouple functions are listed in the following table:

Digistrip III Thermocouple Functions

Thermocouple Type	Function Number
Type E	04
Type J	05
Type K	06
Type T	09

6. Place the test thermocouple sensor(s) in the ice point reference (or crushed ice bath) and allow them to temperature stabilize for approximately five minutes.

7. Using the Digistrip III's keyboard, call up the test channel and observe the reading displayed.

8. Open the rear panel of the Digistrip III and locate the adjusting screw on potentiometer P1 of the appropriate channel access board (P1 is mounted on the right edge of the boards).

9. Using a small screwdriver, adjust P1 such that the test channel display reads 0.0°C or 32.0°F, then immediately close the instrument's rear door.

10. To calibrate other channel block RTDs, repeat steps 7 and 9 (above) using the appropriate test channels.

SECTION 3 - SERVICE

3.1 Introduction

Although the Digistrip III is designed to provide long-term reliable operation, occasional component failures may require corrective action. Because most of the components are not user-serviceable, repairs normally are made by exchanging one or more defective circuit board assemblies. To facilitate these exchange procedures, all circuit boards are mounted in easily accessible locations and are easy to exchange. The following subsections provide detailed information on the circuit board exchange procedures, together with information on certain circuit board adjustments.

3.2 V1060 Power Supply Adjustment

The Digistrip III Power Supply (part number V1060) is a tap-switching power source. It is designed to automatically select the proper transformer tap as the input voltage varies over the instrument operating range. All power supplies are factory-adjusted by Kaye Instruments prior to shipping and normally need no further adjustment. If adjustment is needed, however, it may be done according to the procedure described below. The adjustment procedure varies the point on the Power Supply load curve at which the taps switch.

Equipment Required

- Voltmeter (capable of 0.01V resolution on 20VDC range)
- Clip-on voltmeter lead wires
- 5/64" hex key
- 11/32" open-end wrench or small adjustable wrench
- Small screwdriver with insulated shaft

Adjustment Procedure

1. With the Digistrip's Load/Run switch set in the LOAD position, the power switch turned OFF, and the power cord disconnected, open the front door and slide the chassis forward on its rails. Whenever the chassis is slid forward, take precautions to prevent the unit from tipping.

2. Tear off and remove the paper stack from the upper paper tray.

3. Remove the hold-down screws from the front edge of the upper paper tray and lift the tray out of the instrument. With the upper paper tray removed, the Power Supply will be visible inside the chassis.

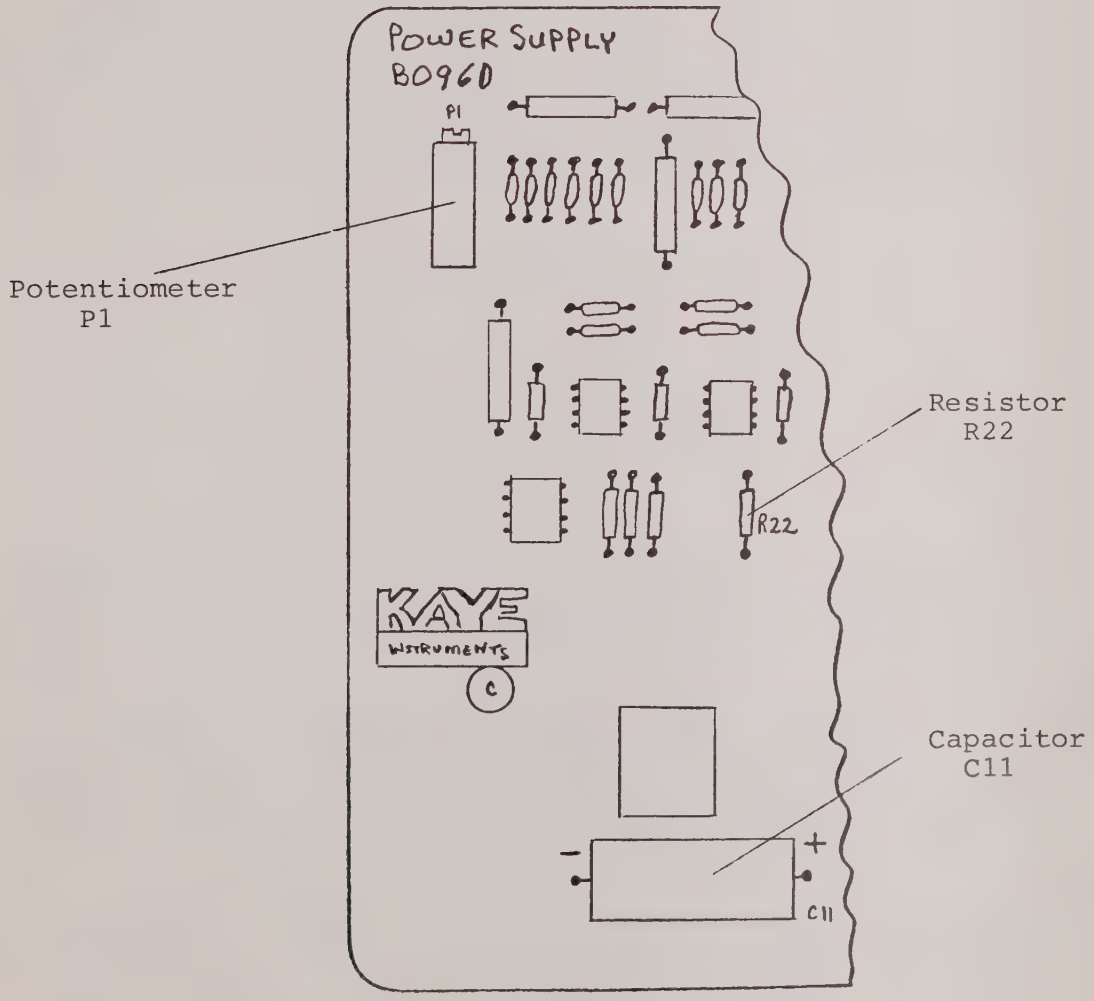
   Caution: The Digistrip power supply contains High Voltage circuits. To preclude possible injury, make sure that the power cord is disconnected before proceeding with steps 4 through 9 below.

4. Remove the three mounting nuts from the power supply base plate and carefully tilt the upper edge of the supply toward the front of the instrument.

5. Examine the Power Supply and locate transformers T1 and T2. When standing in front of the instrument, T1 is the rightmost transformer on the power supply base plate and T2 is the adjacent transformer. A code number is marked on the top of each transformer. T1 and T2 may be present in any one of three code number combinations. The reference voltage used in the

Power Supply adjustment procedure will depend upon the T1 and T2 transformer combination present. Note the code numbers on T1 and T2; this information will be used in step 11 below.

6. With the Power Supply tilted forward, examine the circuit board and locate capacitor C11 and resistor R22. The positions of these components are shown in the diagram below.



7. Position the voltmeter near the Digistrip unit and select the 20VDC range.

8. Clip the voltmeter's red (+) lead wire to the top end of resistor R22 (see diagram).

9. Clip the voltmeter's black (-) lead wire to the negative end of capacitor C11 (see diagram). The negative end of C11 is the end closest to the edge of the circuit board.

10. Connect the Digistrip power cord to a properly grounded electrical outlet and turn the power switch ON.

11. Using the voltmeter, measure the reference voltage between the two test points. Depending upon the T1 and T2 transformer combination present (see step 5 above), the reference voltage for a properly adjusted power supply should be either 11.20±0.06 VDC or 12.00±0.06 VDC. The prescribed reference voltages for the various transformer combinations are listed in the following table:

Prescribed Reference Voltages

Transformer T1	Transformer T2	Prescribed Reference Voltage
241-7-1552	241-6-1579	11.20±0.06 VDC
241-7-1552	241-6-12	12.00±0.06 VDC
241-7-1379	241-6-12	12.00±0.06 VDC

12. If the measured voltage of the unadjusted power supply is at the prescribed level, omit step 13 and proceed to step 14. If the measured voltage of the unadjusted power supply is not at the prescribed level, proceed with step 13.

13. If the measured voltage of the unadjusted power supply is not at the prescribed level, locate potentiometer P1 on the power supply circuit board (see diagram in step 6 above) and carefully adjust its set screw to provide the prescribed reference voltage. Turning the set screw clockwise increases the voltage; turning it counterclockwise decreases the voltage.

14. Once the reference voltage is properly adjusted, turn the Digistrip's power switch OFF and disconnect the power cord.

15. Disconnect the voltmeter lead wires from the power supply test points.

16. Reposition the power supply on the mounting studs and reinstall the mounting nuts.

17. Reinstall the upper paper tray and load a paper stack into the instrument.

18. Slide the chassis back into the instrument and close the front door.

19. Reconnect the power cord and resume normal instrument operation.

3.3 V1060 Power Supply Exchange

The Digistrip III Power Supply (part #V1060) is a tap-switching power source. It is designed to automatically select the proper transformer tap as the input voltage varies over its operating range. Replacement power supplies are factory-adjusted prior to shipment and normally need no further adjustment at time of installation.

Material Required

11/32" open-end wrench or small adjustable wrench
5/64" hex key

Exchange Procedure

1. With the power switch turned OFF and the power cord disconnected, open the front door of the instrument and slide the chassis forward on its rails. When sliding the chassis forward, take precautions to assure that the instrument does not tilt forward.

2. Remove the two screws holding the front edge of the upper paper tray and lift the tray out--rear edge first. The Power Supply will now be visible at the bottom rear of the chassis.

3. Disconnect the two multi-pin wire connectors from the Power Supply circuit board.

4. Remove the three nuts holding the Power Supply to the chassis base plate.

5. Grasp the Power Supply assembly by its transformers or heat sink (do not grasp the large capacitors), tilt the assembly forward and carefully lift it out of the instrument.

6. Install a replacement Power Supply (part #V1060) in the instrument by reversing the above procedures. When installing the replacement assembly, be sure to orient the wire connectors in the same manner as the old Power Supply hook-up. Also, take precautions to avoid disturbing the instrument wiring in areas surrounding the Power Supply location.

3.4 U0900 Print Control Board Exchange

The U0900 Print Control board controls outputs to the Digistrip III's internal printer. All Print Control boards are factory adjusted prior to shipment and normally need no further adjustment at the time of installation. Whenever a print control board is installed in a Digistrip III, the operation of the instrument's printer should be checked out to assure satisfactory print quality. If adjustment is needed, it may be made at that time.

Test Equipment Required

Oscilloscope
Small screw driver
¼" nut driver
Phillips screwdriver

Exchange Procedure

1. With the power switch turned OFF and the power cord disconnected, open the front door and slide the Digistrip III chassis forward on its rails. When doing this, take precautions to assure that the instrument does not tip forward.

2. Remove the black metal cover plate from the right side of the chassis by unscrewing the four cover attachment screws.

3. Remove the four stand-off studs from the Print Control Board with a ¼" nut driver.

4. Detach the two multi-pin cable connectors from the rear edge of the Print Control Board. When detaching connectors, note their orientation.

5. Detach the six-pin cable connector and ribbon cable connector from the back side of the circuit board. Note the orientation of the ribbon cable connector. The six-pin connector is non-polarized.

6. Remove the old circuit board from chassis.

7. Attach the six-pin cable connector to the back side of the replacement circuit board (part no. U0900). Because this connector is non-polarized, its orientation does not matter on replacement.

8. Attach the ribbon cable connector to the back side of the replacement circuit board. Make sure that the connector is properly oriented. Take special care to ensure that all the pins are properly mated with the ribbon connector.

9. Attach the two multi-pin cable connectors to the rear edge of the replacement circuit board. Make sure that both connectors are properly oriented.

10. Attach the replacement circuit board to the chassis with the four standoff studs.

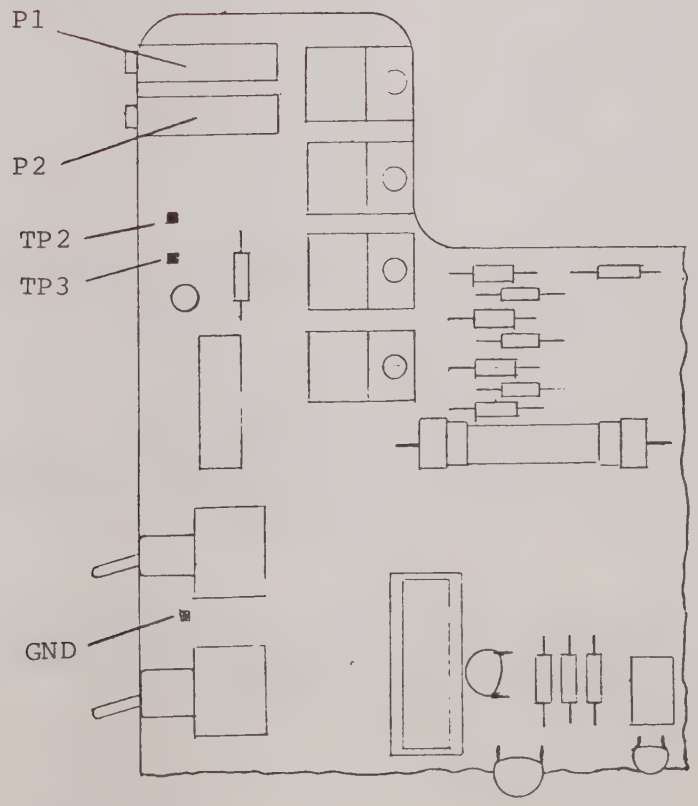
11. Re-install the cover plate with the four attaching screws.

12. Plug-in the Digistrip's power cord and turn the instrument ON. Whenever the instrument is first turned ON, it automatically prints out a new header.

13. Examine the print quality of the printed header. If adjustment is needed, it may be done according to the procedure described below.

Adjustment Procedure

1. Adjustments of the Print Control Board outputs are made by adjusting potentiometers P1 and P2 on the circuit board. On Revision E and later Print Control boards P1 and P2, as well as the test contact pins are accessible with the black metal cover plate in place (see diagram below).



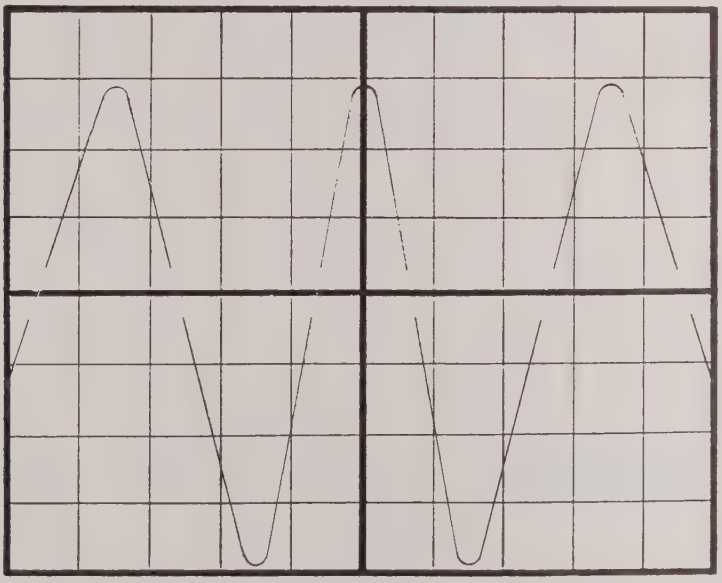
2. Program the Digistrip III for a log interval of zero and switch to the RUN mode. This will cause the instrument to print out at ten second intervals.

3. Connect the oscilloscope's ground strap to the GROUND pin on the print control board (see diagram above).

4. Touch the oscilloscope's probe to test pin 3 (TP3) or to the top of capacitor C5 on the print control board (see diagram above).

5. Turn the oscilloscope ON and set it to register 0.5V/division and 2ms/division.

6. During printouts, observe the oscilloscope screen for a timing pulse sine wave with a hysteresis point on the center horizontal line. When the timing pulse is properly adjusted, the portion of the wave above the hysteresis point will be 1.5 V, while the portion below will be 2.0 V. The diagram below shows the sine wave for a properly adjusted timing pulse.



7. Adjust the set screw on potentiometer P2 to provide the proper timing pulse as described in Step 6 above. Turning the set screw clockwise will decrease the voltage above the hysteresis point; turning it counterclockwise will increase the voltage below the hysteresis point.

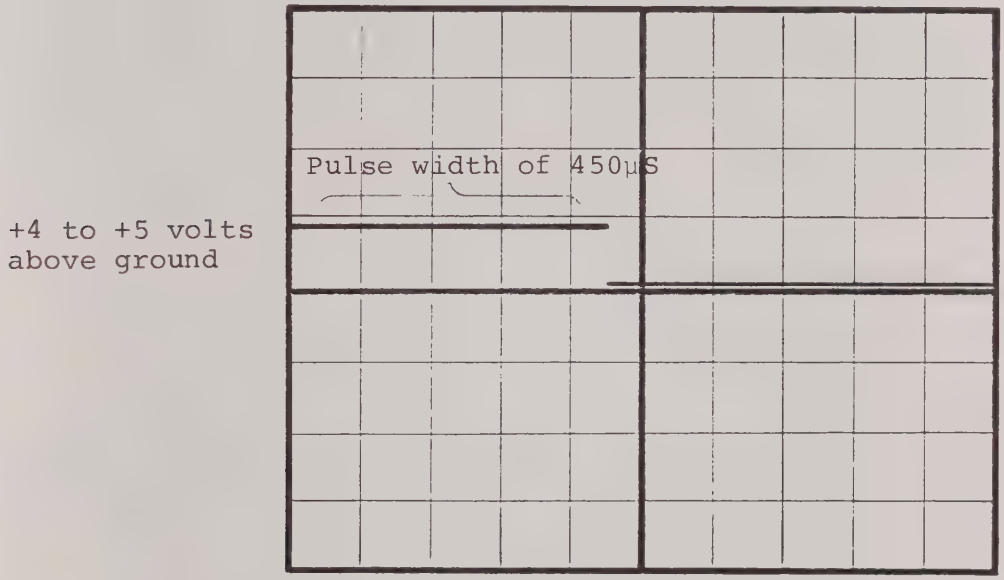
8. Potentiometer P1 is used to adjust the print hammers for a striking force which will produce an image of moderate intensity, with no character deformation.

9. Attach scope probe to test point 2.

10. The trace should be aligned to start at the left-most vertical line and adjusted to ground potential.

11. Set the SEC/DIV control to a sweep speed of 0.1 ms, and the VOLTS/DIV to 5 volts. Adjust the LEVEL control as necessary to stabilize the signal.

12. Turn P1 until a pulse width of 450 µS is achieved. Below is an example of how the scope screen should look when this calibration is correctly completed.



13. Proper positioning of the print platen also affects print quality. Adjustment of the platen is not normally required. However, if platen adjustment is needed, it is done as follows:

14. Tear off and remove the paper from the printer.

15. Position the printhead at either end of the platen and turn the Digistrip III power switch OFF. If the printhead is not at the end of the platen, briefly turn the instrument power ON; this will cause the printhead to move to one end or the other. Next, loosen the two hex key screws at the end of the platen at which the printhead is currently positioned. Using a feeler gauge, adjust the platen-to-print head clearance to 0.015 inches, then tighten the two hex screws. When tightening the hex screws, make sure that the platen is vertically positioned to provide uniform print head contact.

16. After adjusting one end of the platen, briefly turn the Digistrip III power ON; this will cause the printhead to move to the other end of the platen. With the printhead at the other end, adjust the platen-to-print head clearance at that end in the same manner as described above.

3.5 U0911 Data Acquisition Board Exchange

The U0911 data acquisition board controls the operation of all Digistrip III systems. This board contains a microprocessor and memory storage capacity, as well as all I/O signal circuitry. The data acquisition board is located on the left side of the chassis.

Material Required

- Phillips Screwdriver
- 1/4" Nut Driver

Exchange Procedure

1. With the AC power cord unplugged, open the Digistrip III's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward. With the chassis slid forward, the data acquisition board will be visible behind a black metal panel on the left side of the chassis.

2. Remove the metal panel covering the data acquisition board.

3. Disconnect the ribbon cable from the front edge of the board. When doing this, note the orientation of the cable and connector.

4. Disconnect the three cable connectors from the rear edge of the board. Again, take note of the orientation of these cables and connectors.

5. Unscrew the six stand-off studs and carefully remove the board.

6. To install the replacement board, simply reverse the procedures described above. When installing a replacement board, make sure that all cables and connectors are properly oriented.

7. Once the replacement board is installed, set the ten-position DIP switch located on the right center of the board for the same configuration as that of the original board. Alternately, the zero width adjustment procedures may be performed. For details on performing the zero width adjustment, see Section 2.3.

8. Set the Baud rate selection jumper in the same position as that of the old board. If no Baud rate jumper was present on the old board, disregard setting this jumper on the replacement board.

9. After doing the above, reconnect the AC power cord, switch the Digistrip III's power ON, then reinitialize and reprogram the instrument.

3.6 U0920 Analog Board Exchange

The Analog printed circuit board (part #U0920) constitutes the input measuring portion of the Digistrip III. It is located inside the rear door of the instrument.

Materials Required

Phillips screwdriver
¼" nut driver

Exchange Procedure

1. Turn the Digistrip III's power switch OFF and unplug the AC power cord. Next, remove the four screws securing the rear door and swing the door open. With the rear door open, the Analog board will be visible behind a black metal heat shield on the inner bulkhead.

2. Remove the heat shield to gain access to the Analog board.

3. Disconnect the two ribbon cables from the lower left corner of the board. To disconnect these cables, spread the connector extractors at both ends of the connector. When disconnecting these cables, note their orientation.

4. Disconnect the power leads (two wires) by separating the two halves of the nylon connector.

5. Unscrew the mounting nuts and stand-off studs (or screws) and carefully remove the Analog board from the instrument.

6. Before installing the replacement Analog board, look for a tag located to the right of capacitors C1 and C2 at the top edge of the circuit board. This tag will be marked with several digits separated by commas. These digits are the Analog board zero width settings. Note these digits; they will be used later in setting the slide positions on the Data Acquisition board's DIP switch.

7. Install the replacement Analog board (part #U0920) by reversing the procedures listed above. When connecting the cables to the replacement board, be sure to orient them in the same manner as the original board.

8. Reinstall the heat shield, then close and resecure the rear door.

9. Once the replacement Analog board is installed, the zero width adjustment must be set on the Data Acquisition board's DIP switch; the following steps describe this procedure.

10. Open the Digistrip III's front door and slide the chassis forward on its rails. When doing this, make sure that the instrument does not tilt forward.

11. Locate the blue DIP switch mounted in the center of the Data Acquisition board.

12. Once this DIP switch has been located, set each of the ten numbered switch slides as follows:

    - Set the slide ON if its number was listed on the tag of the Analog board.

    - Set the slide OFF if its number was <u>not</u> listed on the tag of the Analog board.

    - Slide 10 should <u>not</u> be altered.

    Setting the numbered DIP switch slides as described above adjusts the zero width to within one count; this is sufficient for almost all measurements. If finer adjustment is necessary, the zero width may be set according to the procedure described in Section 2.3 of this supplement.

3.7 U0930 Channel Access Board Exchange

Each Digistrip III contains either one, two or three channel access boards (part #U0930). These boards receive analog inputs via their isothermal terminal blocks and multiplex these inputs to the digital voltmeter. All U0930 channel access boards are factory adjusted prior to shipment and normally need no further calibration at the time of installation. When used with thermocouple inputs, however, the internal reference RTD should be recalibrated from time to time. Section 2.4 of this Supplement provides a detailed description of the RTD calibration procedure.

The channel access boards are mounted either (A) on the standard rear door panel, or (B) in a high accuracy thermocouple input panel attached to the rear door. The following procedures describe the techniques used to isolate and exchange a defective channel access board.

Materials Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver

Defective Board Isolation Procedure

1. With the Digistrip's power cord connected to a line voltage outlet, the power switch turned ON and the PROGRAM/RUN switch set in the PROGRAM position, initiate a printout of complete program information by pressing the LIST PROGRAM key.

2. Once the program printout is completed, review it carefully to make sure that all programmed instructions are accurate and complete. If program changes are required, they should be made at this time.

3. From the table below, select the symptom which represents the system problem being experienced. Having selected the problem symptom, proceed to the steps indicated.

Problem Symptom	Proceed to Steps
All channel data readings are improper	4 - 10
All channel data readings for a particular terminal bank are improper.	11

Problem Symptom	Proceed to Steps
All thermocouple readings for a particular terminal bank are improper.	12 - 17
Individual channel data values are improper.	18

4. Place the PROGRAM/RUN switch in the PROGRAM position and assign Function 01 (the 65 mv DVM measuring scale) to the first channel of the channel line assigned to each terminal bank. For example, in a system containing two terminal banks, if Channel Line 100 is assigned to Terminal Bank 1, and Channel Line 200 is assigned to Terminal Bank 2, Function 01 would be assigned to Channels 101 and 201.

5. After completing step #4 above, reset the PROGRAM/RUN switch in the RUN position and turn the power switch OFF.

6. Open the Digistrip's rear door and remove the black metal plate covering the analog board.

7. Locate the small neon bulb mounted in the lower left corner of the analog board. Short out this bulb by connecting a jumper across its two lead wires.

8. Disconnect the small ribbon cable at the lower left corner of the analog board.

9. Turn the power switch back ON and examine the displayed value of the first channel in the channel group assigned to each terminal bank.

10. If the first channel assigned to each terminal bank reads approximately 00.000 mv, the first channel access board (terminal bank 1) probably is defective and in need of replacement. If the first channel assigned to each terminal bank reads other than approximately 00.000, the analog board probably is defective and in need of replacement.

11. If all data readings for a particular channel access board are improper, that channel access board probably is defective and in need of replacement.

12. If all thermocouple readings for one or more channel access boards are improper, but other input types read properly, proceed to step #13.

13. With the PROGRAM/RUN switch set in the RUN position, call up the displayed value of the data in channel 906. Channel 906 provides the voltage measurement across the internal temperature measuring RTD of the first channel access board (Terminal Bank 1). Under normal ambient temperature conditions--15° to 32°C (60° to 90°F), the displayed value of channel 906 should be in the 31 to 35 mv range. Any reading outside of this range is indicative of a component failure.

14. If the Digistrip has a second channel access board (Terminal Bank 2), call up the displayed value of the data in channel 907. Channel 907 provides the voltage measurement across the internal temperature measuring RTD of Terminal Bank 2. As with channel 906, under normal ambient temperature conditions, this voltage measurement should be in the 31 to 35 mv range.

15. If the Digistrip has a third channel access board (Terminal Bank 3), call up the displayed value of the data in channel 908. Channel 908 provides the voltage measurement across the internal temperature measuring RTD of Terminal Bank 3. As with channels 906 and 907, under normal ambient temperature conditions, this voltage measurement also should be in the 31 to 35 mv range.

16. If one or more of the internal RTD readings are outside of the 31 to 35 mv range, the channel access board associated with that RTD probably is defective and in need of replacement.

17. If all internal RTD readings are within the 31 to 35 mv range, but thermocouple readings are still improper, contact your nearest Kaye Instruments customer service office.

18. If individual channel data inputs read improperly, proceed with step #19.

19. If several inputs which are assigned the same DVM analog range read improperly, reprogram those inputs for a different voltage range. If the inputs read correctly after changing the range the analog board probably is defective and should be exchanged. If reassigning the input range does not correct the readings, restore the original function assignment and proceed with step #20.

20. Move each input which reads improperly to an unused input address and assign the proper function number. If the relocated input reads properly, the channel access board has a defective input relay. The channel access board should be exchanged. If the improper reading follows the input wiring, the sensor itself probably is defective and should be repaired.

Exchange Procedure (for standard rear door panels)

1. With the instrument's power switch turned OFF and the power cord disconnected, remove the input terminal cover from the rear of the instrument and disconnect all input leads from the board to be exchanged.

2. Remove the four mounting screws from the board to be exchanged.

3. Remove the four securing screws from the rear door and swing the door open. With the rear door open, the channel access board(s) will be visible on the inside of the door.

4. Disconnect the ribbon cable connector from the left side of the board to be exchanged.

5. Remove the nut from the mounting stud at the left side of the board, lift the board off the stud and slide it to the right and off the door.

   Note: When removing an old channel access board, observe the position of the Group Select jumper and set the new board's jumper in the same position.

6. Install the replacement board by reversing the procedures described above.

   Note: When installing a channel access board as a system expansion, the new board must be installed in place of a blank cover plate on the instrument's rear door. Whenever an expansion board is installed, it must be connected to the ribbon cable. Also, it must have its Group Select jumper set for the new group of channels. When setting this jumper, make sure that its setting does not duplicate that of any other channel access board in the system.

Exchange Procedure (for high accuracy thermocouple input panels)

1. With the instrument's power switch turned OFF and the power cord disconnected, remove the input terminal cover from the high accuracy panel and disconnect all input leads from the board to be exchanged.

2. Remove the two mounting screws from the left side of the terminal block of each board.

3. Remove the two mounting screws from the right side of the terminal block of the board to be exchanged.

4. Remove the two rear door securing screws from the left end of the high accuracy panel and swing the door open.

5. With the panel door open, slide the mounting plate off the end of the door and disconnect the ribbon cable connector from the left side of the board to be exchanged.

6. Remove the nut from the mounting stud at the left side of the board to be exchanged. Lift the board off the stud and slide it to the right and off the door.

   Note: When removing an old channel access board, observe the position of the Group Select jumper and set the new board's jumper in the same position.

7. Install the replacement board by reversing the procedures described above.

   Note: When installing a channel access board as a system expansion, the new board must be installed in place of a blank cover plate on the high accuracy panel. Whenever an expansion board is installed, it must be connected to the ribbon cable. It also must have its Group Select jumper set for the new group of channels. When setting this jumper, make sure that its setting does not duplicate that of any other channel access board in the system.

3.8 V1030 Carriage Motor Exchange

When printing out information, the printhead of the Digistrip III moves back and forth across the page. It is mounted on two slide bars and driven by a chain assembly powered by a carriage motor (part #V1030). The carriage motor is located beneath the upper paper tray near the right side of the chassis.

Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- 11/32" Nut Driver
- Allen Wrench Set
- Molex Pin Extractor

Exchange Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the paper from the printer.

3. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis--rear edge first.

4. Remove the mounting screws from the front of the black metal paper guide and lift the guide off the chassis.

   Note: For some early production Digistrip III units, it is necessary to remove the data acquisition board (left side of chassis) and the print control board (right side of chassis) to gain access to the paper guide mounting screws. For instructions on the removal of these boards, see Sections 3.5 and 3.4

5. Locate the carriage motor which is mounted near the right side of the chassis interior.

   Note: When exchanging the carriage motor, take precautions to avoid touching, soiling, or damaging the delicate optical timing fence located in the printhead area.

6. Disconnect the carriage motor power cable. The connector on this cable is located in the lower rear right corner of the chassis.

7. Using the Molex pin extractor, disassemble the connector on the carriage motor power cable.

8. Loosen the carriage motor mounting screws, remove the drive chain from the drive gear, and lift the carriage motor out of the chassis (see Section 3.12 for details).

9. Install a new carriage motor (part #V1030) by reversing the procedures described above.

10. Once the replacement carriage motor is properly installed, close up the instrument and resume normal monitoring operations.

3.9 M3130 Timing Fence Exchange

The character printout timing of the Digistrip's printhead is controlled by the optical timing fence (part #M3130). The timing fence is a transparent plastic strip marked with opaque vertical lines. It is mounted in the front interior area of the chassis. As the printhead moves back and forth across the page, its photo detector scans the timing fence and transmits a sequence of timing signals to the print control board. These signals in turn control the character printout timing.

Note: Because of the critical nature of its optical properties, the timing fence must be kept clean and free from damage. When handling a timing fence, avoid touching, soiling, or damaging its critical areas.

Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- Allen Wrench Set

Exchange Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the paper from the printer.

3. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis--rear edge first.

4. Remove the mounting screws from the front of the black metal paper guide and lift the guide off the chassis.

   Note: For some early production Digistrip III units, it is necessary to remove the data acquisition board (left side of chassis) and the print control board (right side of chassis) to gain access to the paper guide mounting screws. For instructions on the removal of these boards, see Sections 3.5 and 3.4.

5. Standing in front of the instrument, examine the chassis interior and locate the timing fence. Note that it is oriented with the line pattern side down and the clear area on the left.

6. Loosen the screws used to attach the timing fence mounting brackets to both chassis side panels.

7. Remove the old timing fence from the instrument.

8. Remove the mounting brackets from the old timing fence and mount them on the new one.

9. Install the replacement timing fence in the instrument by reversing the procedures described above. When doing this, make sure that the new fence is oriented in the same manner as the old one (see step #5 above).

10. Adjust the alignment and tension of the timing fence by proper positioning of its mounting brackets. When the timing fence is properly installed, the printhead's photo detector should move along the fence without touching it.

11. Once the replacement timing fence is properly installed, close up the instrument and resume normal monitoring operations.

3.10 V1010 Printhead Exchange

The Digistrip printhead (part #V1010) is an electro-mechanical impact printing device. The printing mechanism consists of seven vertically aligned print hammers. As the printhead moves back and forth across the page, the print hammers strike the pressure-sensitive paper, thereby creating the printed characters.

Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- Allen Wrench Set

Exchange Procedure

1. With the power cord connected to a line voltage outlet, the power switch turned OFF and the PROGRAM/RUN switch set in the RUN position, remove the paper from the Digistrip's printer.

2. Turn the power switch ON. When the power switch is turned ON, the printhead will move across the paper area in one direction and stop. Turn the power switch OFF. The next time the power switch is turned ON, the printhead will move in the other direction and stop. With the paper removed from the printer, the front end of the printhead will be visible beneath the black metal paper guide.

3. Starting with the power switch turned OFF and the printhead at the right side of the paper area, turn the power switch ON. When the printhead reaches the middle of the paper area, stop its movement by turning the power switch OFF.

4. Disconnect the power cord and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

5. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis--rear edge first.

6. Remove the print control board (right side of chassis). For instructions on the removal of this board, see Section 3.4.

7. Remove the mounting screws from the front of the black metal paper guide and lift the guide off the chassis.

Note: For some early production Digistrip III units, it is necessary to remove both the data acquisition board (left side of chassis) and the print control board (right side of chassis) to gain access to the paper guide mounting screws. For instructions on the removal of the data acquisition board, see Section 3.5.

8. Locate the printhead. Note that it is mounted on two horizontal slide bars.

   Note: When conducting the printhead exchange procedure, take precautions to prevent touching, soiling, or damaging the delicate optical timing fence located in the printhead area.

9. Disconnect the drive chain from the printhead by carefully lifting the upper chain span and removing the drive pin from its vertical track. Once the pin has been removed from its track, the tension on the chain should hold the pin in place in the chain end links.

   Note: As an alternative procedure for disconnecting the drive chain from the printhead, the chain may be carefully pulled forward off the drive pin.

10. Once the drive chain is disconnected from the printhead, use a small screwdriver to remove the "C" clips from both ends of the printhead's rear slide bar.

11. Carefully pull the rear slide bar out of the chassis through the right side panel. When the rear slide bar is removed, the printhead will be left resting on the front slide bar.

12. Unplug the printhead ribbon cable from the cable connector mounted on the chassis' right side panel. When doing this, take note of the orientation of the cable.

13. Carefully lift the printhead off the front slide bar and out of the instrument. When doing this, avoid touching or damaging the optical timing fence.

14. Install the replacement printhead in the instrument by reversing the procedures described above. When hooking up the ribbon cable connector, make sure that the cable is installed without twists and that the connector pins are properly aligned. Improper connection of the ribbon cable may result in permanent damage to the printhead.

15. Once the replacement printhead has been installed, close up the instrument and resume normal monitoring operations.

3.11 W1560 Paper Take-Up Motor Exchange

Paper is fed through the Digistrip's printer by the tractor drive mechanism. This mechanism is powered by the paper take-up motor (part #W1560). The paper take-up motor is mounted on the right side panel of the chassis.

Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- Allen Wrench Set

Exchange Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this take precautions to prevent the instrument from tipping forward.

2. Remove the print control board (right side of chassis). For details on the removal of this board, see Section 3.4.

3. Locate the paper take-up motor.

4. Loosen the set screw on the motor pulley and remove the pulley and drive belt.

5. Loosen the motor mounting screws and remove the paper take-up motor from the side panel.

6. Install a replacement motor by reversing the procedure described above. When mounting the replacement motor, make sure that a small amount of play is left in the drive belt. When reconnecting the cables to the print control board, note that the ribbon cable must be properly oriented, while the orientation of the six-pin connector makes no difference.

7. Once the replacement motor has been installed, close up the instrument, reconnect the power cord to a line voltage outlet, turn the power switch ON, and resume normal monitoring operations.

3.12 Printhead Drive Assembly -- Checkout, Adjustment and Lubrication

The printhead drive assembly consists of the printhead, two slide bars, the carriage motor, the drive chain, the drive chain connection pin, and two drive gears. In order for the printer to operate normally, all of these components must be in good condition and properly installed and adjusted. In addition, the printhead slide bars must be kept clean, smooth and adequately lubricated. The following checkout, adjustment and lubrication procedure should be carried out whenever the printhead moves erratically, or squeaks during operation.

Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- Allen Wrench Set
- Tri-Flon Lubricant (or thin lubricating oil)

Checkout, Adjustment and Lubrication Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the paper from the printer.

3. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis -- rear edge first.

4. Remove the mounting screws from the front of the black metal paper guide and lift the guide off the chassis.

   Note: For some early production Digistrip III units, it is necessary to remove the data acquisition board (left side of chassis) and the print control board (right side of chassis) to gain access to the paper guide mounting screws. For instructions on the removal of these boards, see Section 3.5 and 3.4.

5. Examine the inside of the chassis and locate the following components:

   - Printhead
   - Slide Bars (2)
   - Carriage Motor
   - Drive Chain
   - Drive Chain Connection Pin
   - Drive Gears (2)

   Note: When working on the drive chain assembly, take precautions to avoid touching, soiling, or damaging the delicate optical timing fence located in the printhead area.

6. Check out the printhead to make sure that its path of movement is unobstructed. If an obstruction exists, remove it.

7. Check out the two printhead slide bars to make sure that they are straight, smooth, clean, and lightly lubricated. If a slide bar is bent, it should be replaced. If a bar is rough, remove it from the instrument and polish it with crocus cloth or fine steel wool. If a bar needs cleaning, wipe it down with alcohol. To lubricate the slide bars, apply a thin, uniform coat of Tri-Flon lubricant (or thin lubricating oil).

   Note: For instructions on how to remove the slide bars, see Section 3.10.

8. Check out the carriage motor to make sure that it is properly mounted (see Section 3.8).

9. Check out the drive chain to make sure that it is properly mounted and stretched tight. If there is slack in the chain, tighten it by adjusting the position of the carriage motor on its mounting bracket.

10. Check out the drive chain connection pin to make sure that it is capable of moving up and down freely in its mounting track.

11. Check out the two drive gears to make sure that they are properly mounted and aligned.

12. After carrying outs steps 1-11 above, reassemble the Digistrip, reconnect the power cord and check out the instrument for proper printhead operation. If the printhead still moves erratically, either the print control board or the carriage motor probably is defective and in need of replacement. For the print control board exchange procedure, see Section 3.4. For the carriage motor exchange procedure, see Section 3.8.

13. Once the printhead malfunction has been corrected, close up the instrument and resume normal monitoring operations.

3.13 U0950 Digital Display Board Exchange

The digital display printed circuit board is mounted on the inside of the Digistrip's front door. It contains an array of LED display elements and indicator lamps. Whenever the instrument is operating, selected LEDs and indicator lamps are visible through windows in the control panel.

Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Double Sided Mounting Tape

Exchange Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal cover from the data acquisition board (left side of chassis) and locate the ribbon cable connector mounted in the upper right corner of the data acquisition board.

3. Unplug the ribbon cable connector from the data acquisition board.

4. Carefully observe how the ribbon cables are mounted on the inside of the front door and fed into the left side of the chassis. Note that double sided mounting tape is used in several areas to hold the cables in place.

5. Unplug the ribbon cable connector from the keyboard printed circuit board. This board is mounted near the lower left corner of the front door interior.

6. Unscrew the four mounting screws from the digital display board and carefully remove the board and ribbon cable assembly from the instrument.

7. Install the replacement digital display board by reversing the steps described above. When installing a replacement board, make sure that the ribbon cables are properly positioned and held in place with double sided mounting tape.

8. Once the replacement digital display board is installed, close up the instrument, connect the power cord to a line voltage outlet, turn the power switch ON, and resume normal monitoring operations.

3.14 M3100 Control Panel Exchange

The Digistrip III control panel (part #M3100) is a touch-sensitive membrane keyboard mounted on the front door of the instrument. All operating and programming instructions are entered via the control panel.

Equipment Required

- Small Regular Screwdriver

Exchange Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and locate the control panel ribbon cable connector mounted in the upper left corner of the door interior.

2. Unplug the ribbon cable connector.

3. Using a small screwdriver, carefully pry loose the left edge of the control panel, then peel the panel off the door and discard it. Clean off any adhesive remaining on the door.

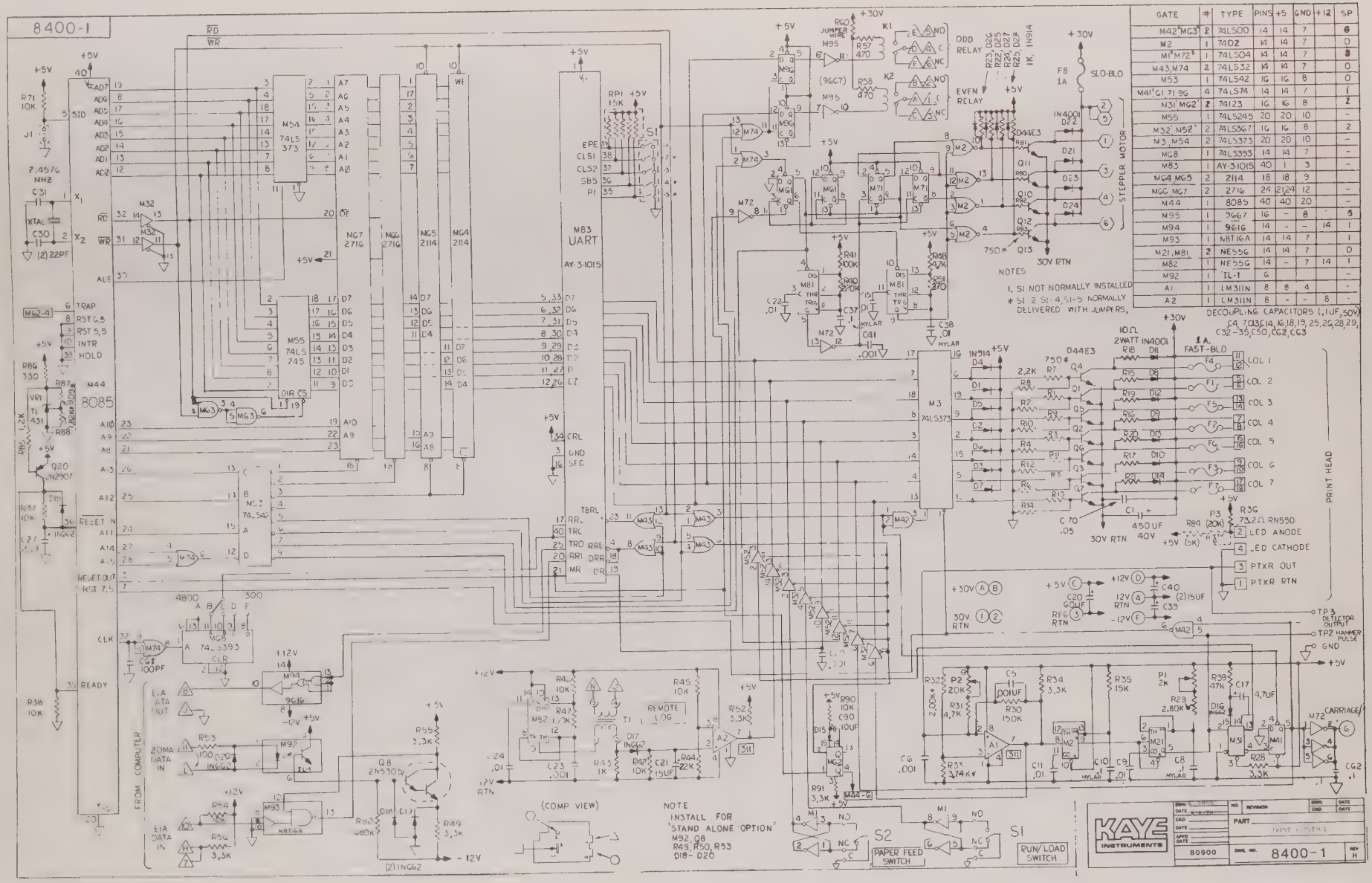
4. Peel the protective backing off the replacement display panel, feed its ribbon cable through the slot near the right edge of the front door and carefully position the panel on the door.

5. After the panel is properly positioned, attach it to the door with firm hand pressure and plug in the ribbon cable connector.

6. Once the replacement control panel has been installed, close up the instrument, connect the power cord to a line voltage outlet, turn the power switch ON and resume normal monitoring operations.

SECTION 4 - SCHEMATICS

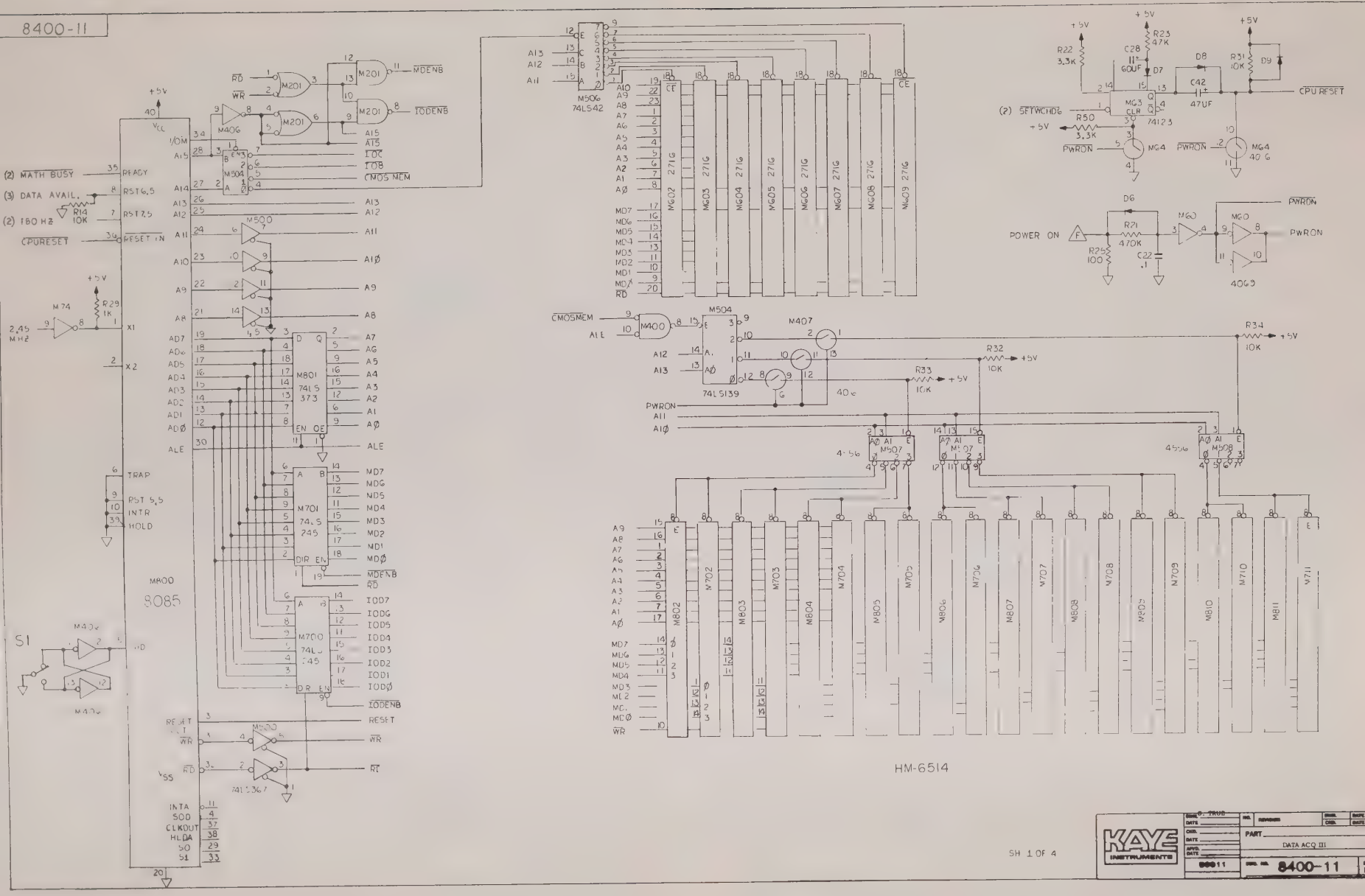
Circuit Board	Drawing Number	Bare Board Number	Finished Board Number	Assembly Number
Print Control	8400-1	B0900	U0900	--
Data Acquisition	8400-11 (Sh. 1 of 4)	B0911	U0911	--
Data Acquisition	8400-11 (Sh. 2 of 4)	B0911	U0911	--
Data Acquisition	8400-11 (Sh. 3 of 4)	B0911	U0911	--
Data Acquisition	8400-11 (Sh. 4 of 4)	B0911	U0911	--
Analog	8400-3	B0920	U0920	--
Channel Access	8400-4	B0930	U0930	--
Display	8400-6	B0950	U0950	--
Power Supply	8400-7	B0960	U0960	V1060

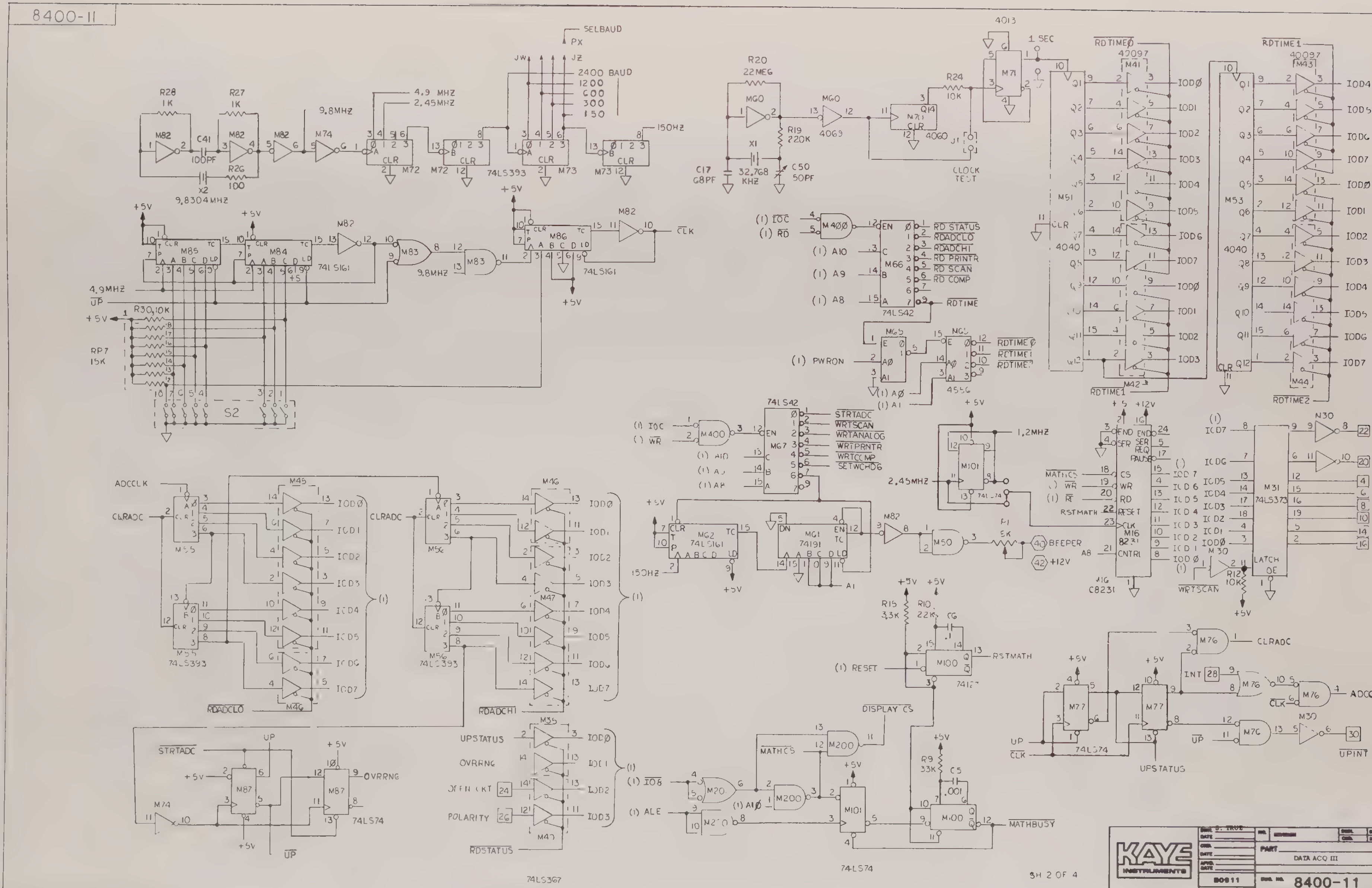


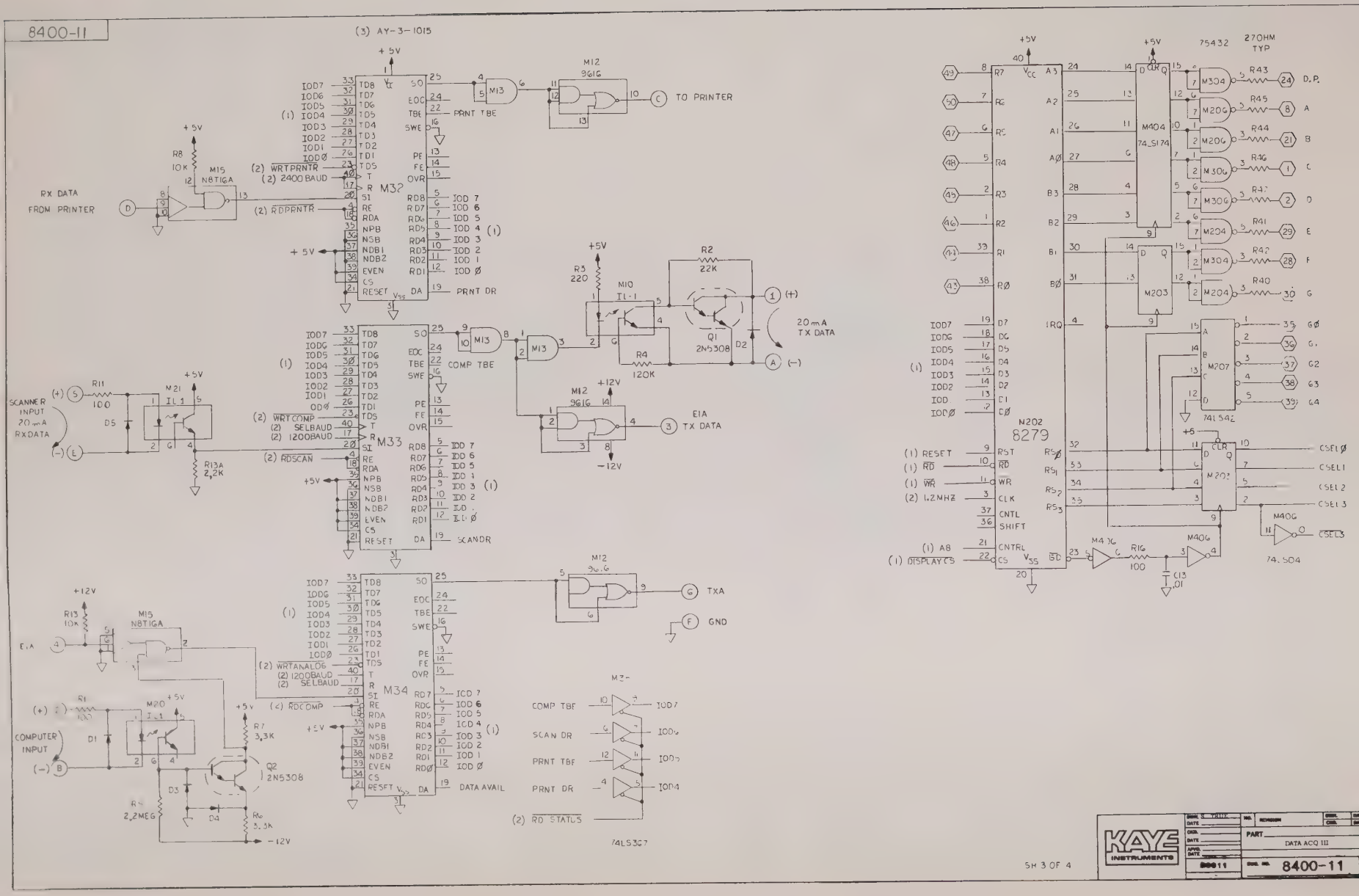
GATE	#	TYPE	PINS	+5	GND	+12	SP
M42, MG3	2	74LS00	14	14	7		3
M2	1	7402	14	14	7		0
M1, M72	1	74LS04	14	14	7		3
M43, M74	2	74LS32	14	14	7		0
M53	1	74LS42	16	16	8		0
MA1, G1, 71, 96	4	74LS74	14	14	7		1
M31, MG2	2	74123	16	16	8		2
M55	1	74LS245	20	20	10		-
M32, N52	2	74LS367	16	16	8		2
M3, M54	2	74LS373	20	20	10		-
MG8	1	74LS393	14	14	7		-
M83	1	AY-3-1015	40	1	3		-
MG4, MG5	2	2114	18	18	9		-
MG6, MG7	2	2716	24	21,24	12		-
M44	1	8085	40	40	20		-
M95	1	9667	16	-	8	-	3
M94	1	9616	14	-	-	14	1
M93	1	NBT16A	14	14	7		1
M21, M81	2	NE556	14	14	7		0
M82	1	NE555	14	-	7	14	1
M92	1	TL-1	6				-
A1	1	LM311N	8	8	4		-
A2	1	LM311N	8	-	-	8	-

DECOUPLING CAPACITORS (.1UF, 50V)
C4, 7, 13, 14, 16, 18, 19, 25, 26, 28, 29, C32-35, C50, CG2, CG3

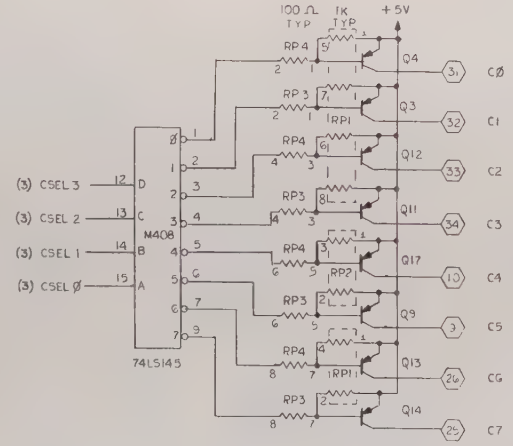
NOTES
1. S1 NOT NORMALLY INSTALLED
* S1-2, S1-4, S1-5 NORMALLY DELIVERED WITH JUMPERS.

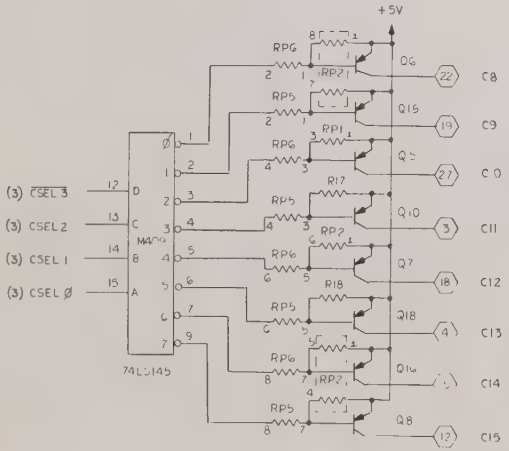

8400-11
8085
8800
(2) MATH BUSY
(3) DATA AVAIL.
(2) 180 Hz
CPURESET
2,45 MHz
SI
SO
INTA
SOD
CLKOUT
HLDA
SO
S1
TRAP
RST 5.5
INTR
HOLD
RESET IN
RESET OUT
READY
RST6.5
RST7.5
X1
X2
IO/M
ALE
RD
WR
MDENB
IODENB
IOC
IOR
CMOS MEM
CMOSMEM
PWRON
POWER ON
CPU RESET
SETWCHD6
HM-6514
SH 1 OF 4
KAYE INSTRUMENTS
DATA ACQ III
8400-11


8400-11
SELBAUD
2400 BAUD
1200
600
300
150
4.9 MHZ
2.45MHZ
9.8MHZ
150HZ
9,8304 MHZ
74LS393
74LS161
CLK
4.9MHZ
UP
RP7
15K
S2
R20
22MEG
32,768 KHZ
4013
1 SEC
CLOCK TEST
RDTIME0
RDTIME1
RDTIME2
40097
4040
RD STATUS
RDADCLO
RDADCHI
RD PRINTR
RD SCAN
RD COMP
RDTIME
74LS42
4556
PWRON
STRTADC
WRTSCAN
WRTANALOG
WRTPRNTR
WRTCCMP
SETWCHDG
1,2MHZ
2,45MHZ
74LS74
BEEPER
+12V
74LS161
74191
8231
C8231
RSTMATH
MATHCS
WRTSCAN
74LS373
LATCH
ADCCLK
CLRADC
RDADCLO
RDADCHI
UPSTATUS
OVRRNG
OPEN CKT
POLARITY
RDSTATUS
74LS367
STRTADC
RESET
DISPLAY CS
MATHBUSY
INT
UPINT
KAYE INSTRUMENTS
DATA ACQ III
SH 2 OF 4
8400-11

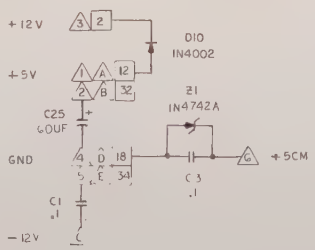

8400-11
(3) AY-3-1015
+5V
M32
M33
M34
M12
9616
TO PRINTER
PRNT TBE
RX DATA
FROM PRINTER
(2) WRTPRNTR
(2) 2400 BAUD
(2) RDPRNTR
PRNT DR
COMP TBE
(2) WRT COMP
(2) SELBAUD
(2) 1200BAUD
(2) RDSCAN
SCANDR
SCANNER
INPUT
20mA
RXDATA
R11
100
D5
R13A
2.2K
M21
IL 1
M13
M10
IL-1
R3
220
R2
22K
Q1
2N5308
R4
120K
D2
20mA
TX DATA
EIA
TX DATA
+12V
-12V
M12
9616
TXA
GND
EIA
R13
10K
M15
N8TIGA
R1
100
D1
M20
IL 1
COMPUTER
INPUT
R7
3.3K
Q2
2N5308
D3
D4
R5
2.2MEG
R6
5.5K
WRTANALOG
(2) 1200BAUD
(2) SELBAUD
(2) RDCOMP
DATA AVAIL
SCAN DR
PRNT TBE
PRNT DR
(2) RD STATUS
74LS367
75432
270HM
TYP
R43
R45
R44
R46
R47
R41
R42
R40
D.P.
A
B
C
D
E
F
G
M404
74S174
M203
M202
M204
M205
M206
M304
M306
N202
8279
(1) RESET
(1) RD
(1) WR
(2) 1.2MHZ
(1) A8
(1) DISPLAY CS
CNTL
SHIFT
M207
74LS42
M406
74S04
R16
100
C13
.01
CSEL0
CSEL1
CSEL2
CSEL3
CSEL4
SH 3 OF 4
KAYE INSTRUMENTS
PART
DATA ACQ III
8400-11

8400-11

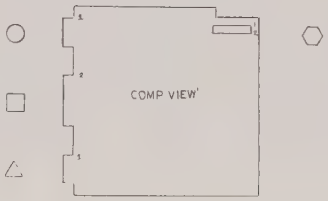




MJE210
TYP
(16 PLACES)



GATE	#	TYPE	PINS	+5	GND	+5CM	+12	-12
MG02–MG09	8	2716	24	24	12			
M702–711 M802–811	20	6514	18	18	9			
M800	1	8085	40	40	20			
M202	1	8279	40	40	20			
M12	1	9616	14		7		14	8
M32, M33, M34	3	AY-3-1015	40	1	3			
M16	1	C8231	24					
M15	1	N8TIGA	14	14	7			
M10, M20, M21	3	IL-1	6	-	-			
M71	1	4013	14		7	14		
M64, M407	2	4016	14		7	14		
M51, M53	2	4040	16		8	16		
M70	1	4060	16		8	16		
M60	1	4069	14		7	14		
M65, M507, M508	3	4556	16		8	16		
M41 – M44	4	40097	16		8	16		
M83, M200, M201	3	74LS00	14	14	7			
M76	1	74LS02	14	14	7			
M74, M82, M406	3	74LS04	14	14	7			
M30	1	7405	14	14	7			
M13	1	7408	14	14	7			
M400	1	74LS32	14	14	7			
MG6, G7, 207, 506	4	74LS42	16	16	8			
M77, M87, M101	3	74LS74	14	14	7			
MG3, M100	2	74123	16	16	8			
M504	1	74LS139	16	16	8			
M408, M409	2	74LS145	16	16	8			
MG2, 84, 85, 86	4	74LS161	16	16	8			
M203, M404	2	74LS174	16	16	8			
MG1	1	74191	16	16	8			
M700, M701	2	74LS245	20	20	10			
M35, 40, 45, 46, 47, 500	6	74LS367	16	16	8			
M31, M801	2	74LS373	20	20	10			
M55, 56, 72, 73	4	74LS393	14	14	7			
M50, 204, 206, 304, 306	5	75432	8	8	4			



SH 4 OF 4

KAYE INSTRUMENTS

PART DATA ACQ III

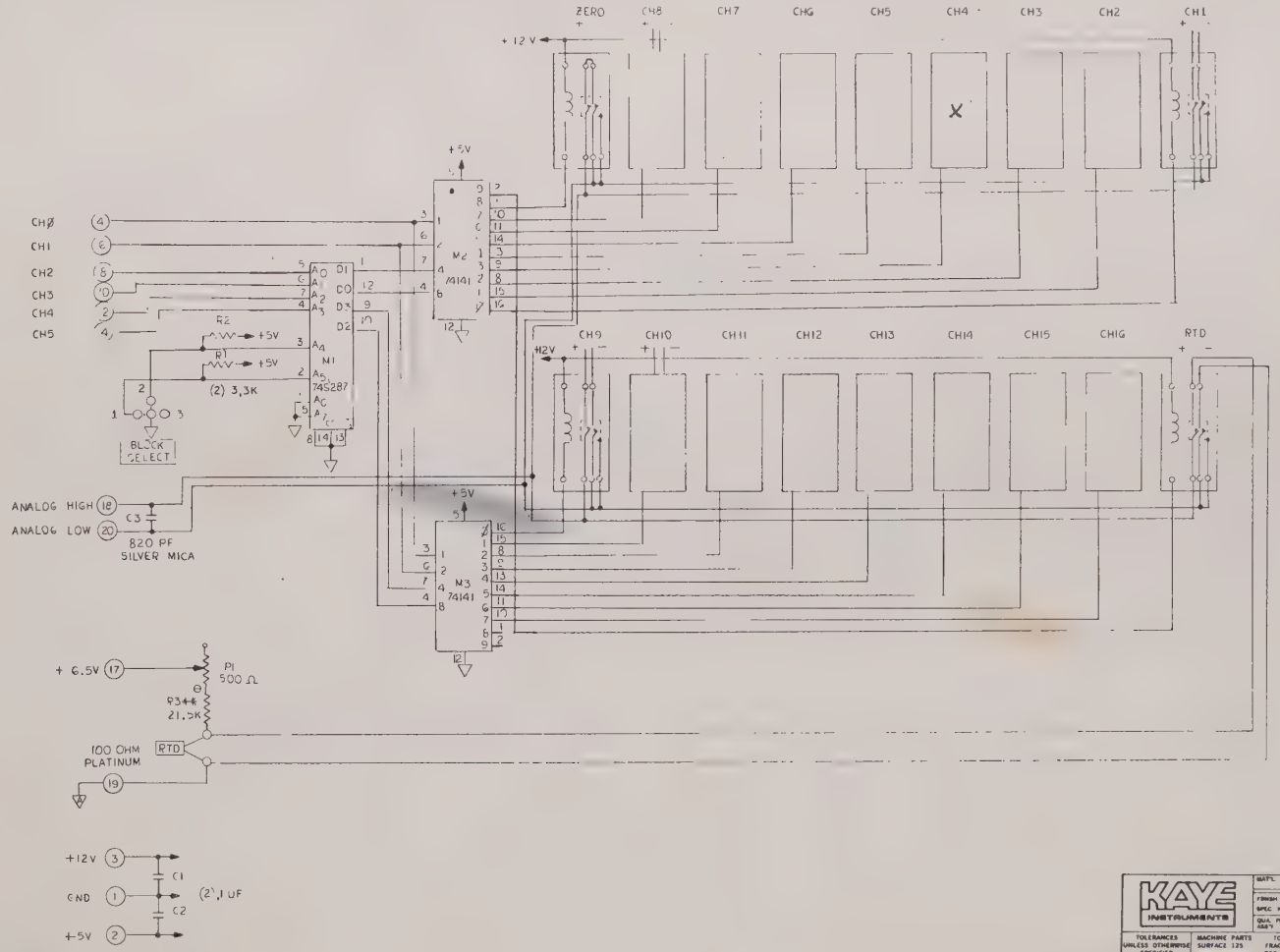
DWG. NO. 8400-11

8400-4

* Blk
Pin #1 Must Be Connected Before Other will work.

GATE	#	TYPE	PWR	+5	GND	SP
M2 M3	2	74141	16	5	12	–
M1	1	74S287	16	K6	8	–
RELAYS	18	3402-12-8		COTO-COIL		

** DENOTES 0.1%



KAYE INSTRUMENTS

MATL		DWN	DATE
FINISH		CKD	DATE
SPEC NO		CKD	DATE
QUAL PER ASS'Y	SPEC SCALE	APVD	DATE
TOLERANCES UNLESS OTHERWISE SPECIFIED	MACHINE PARTS SURFACE 125	TOLER FRAC ± DEC ± .005	DO NOT SCALE USE SPEC DIM

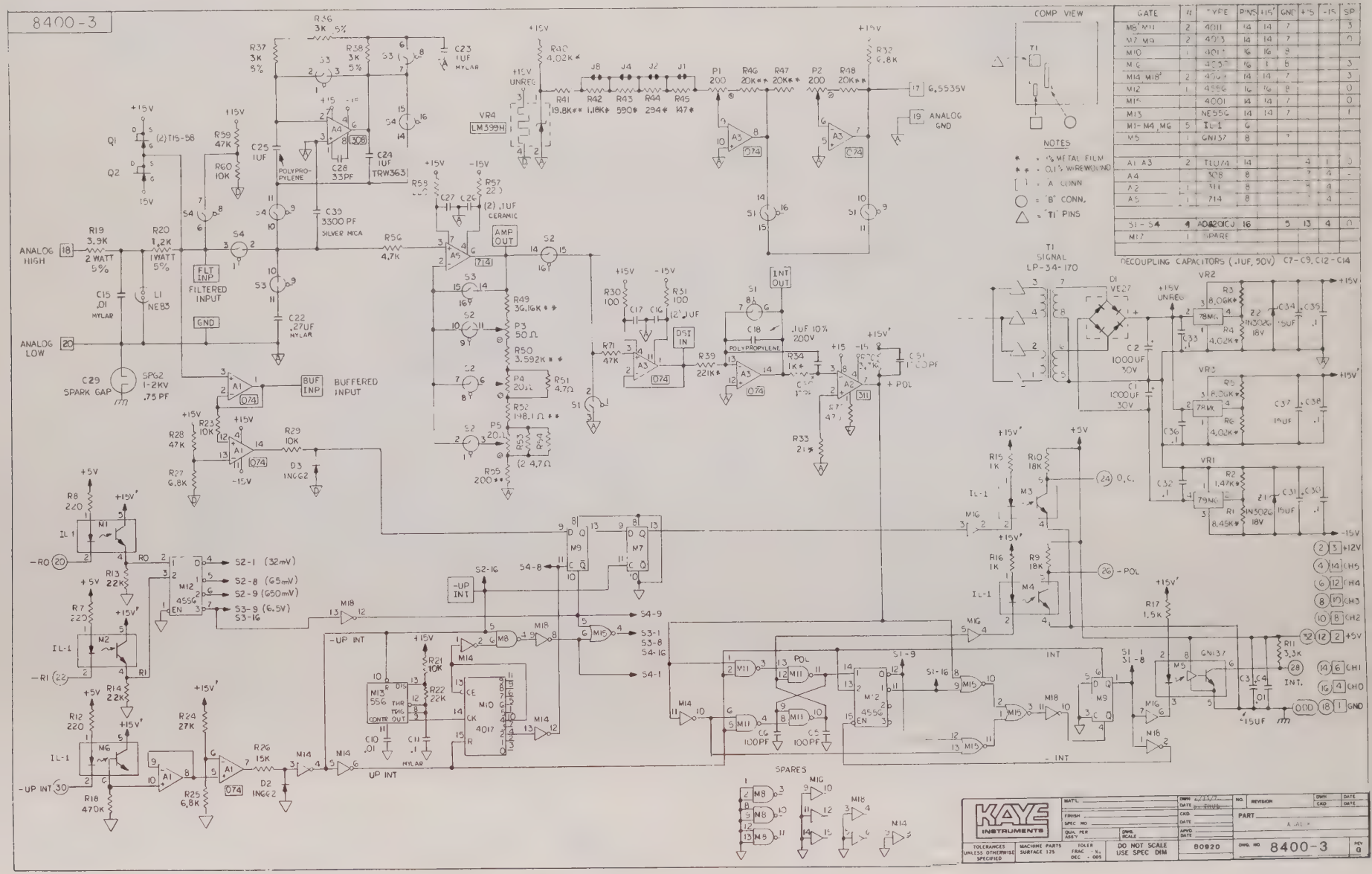
S. TRUE 8/11/78

80930

NO.	REVISION	DWN	DATE
		CKD	DATE

PART — 1 CHANNEL ACCESS

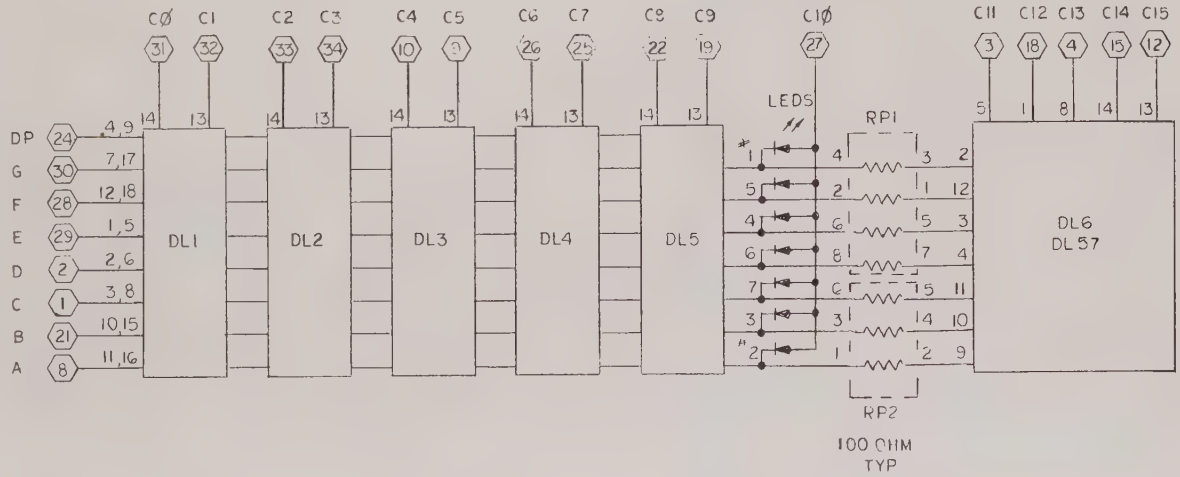
DWG. NO. 8400-4 REV E1



GATE	#	TYPE	PINS	+15	GND	+5	-15	SP
M8 M11	2	4011	14	14	7			3
M7 M9	2	4013	14	14	7			0
M10	1	4017	16	16	8			
M6	1	4030	14	1	8			3
M14 M18	2	4049	14	14	7			3
M12	1	4556	16	16	8			0
M15	1	4001	14	14	7			0
M13	1	NE556	14	14	7			1
M1-M4, M6	5	IL-1	6					
M5	1	GN137	8		7			
A1 A3	2	TL074	14			4	11	0
A4	1	308	8			7	4	-
A2	1	311	8			7	4	-
A5	1	714	8			7	4	-
S1 - S4	4	AD4201CJ	16		5	13	4	0
M17	1	SPARE						

8400-6

GATE	#	TYPE	PINS			SP
DL6	1	DL57	14			-
DL1-DL5	5	DL727	18			-



037E

KAYE INSTRUMENTS

MAT'L
FINISH
SPEC. NO.
QUA. PER ASS'Y.
DWG. SCALE

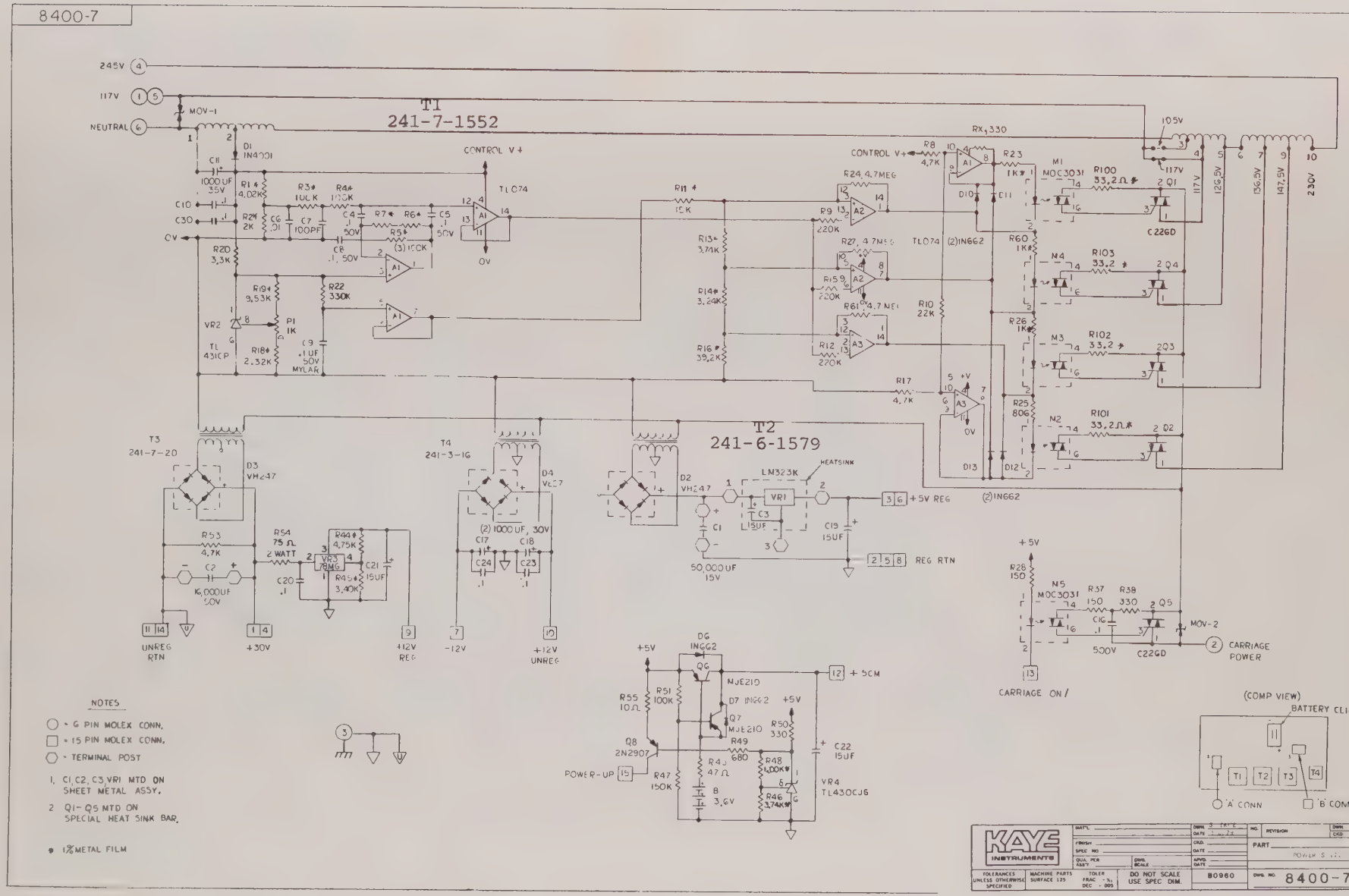
TOLERANCES UNLESS OTHERWISE SPECIFIED
MACHINE PARTS SURFACE 125 — TOLER. FRAC. ±1/32 DEC. ±.005
DO NOT SCALE USE SPEC. DIM.

DWN. DATE S. TRUE 12/4/78
CKD. DATE
APVD. DATE
B0950

NO.	REVISION	DWN.	DATE
		CKD.	DATE

PART DIG. DISPLAY

DWG. NO. 8400-6 REV. D



NOTES

- ○ = 6 PIN MOLEX CONN.
- □ = 15 PIN MOLEX CONN.
- ⬡ = TERMINAL POST

1. C1, C2, C3, VR1 MTD ON SHEET METAL ASSY.
2. Q1 - Q5 MTD ON SPECIAL HEAT SINK BAR.

* 1% METAL FILM

KAYE INSTRUMENTS	MATL	DRWN J. PATE	NO.	REVISION	DRWN / DATE
	FINISH	DATE 1-22			CKD / DATE
	SPEC NO	CKD		PART	
	QUA. PER ASSY	APVD DATE		POWER S...	
FOLERANCES UNLESS OTHERWISE SPECIFIED	MACHINE PARTS SURFACE 125	TOLER FRAC - ½ DEC - .005	DO NOT SCALE USE SPEC DIM.	80960	DWG. NO. 8400-7

SECTION 5 - TROUBLESHOOTING

5.1 Introduction

The Digistrip III is made up of a series of plug-in circuit boards and mechanical assemblies. In order to provide a simplified means of troubleshooting the instrument, the information contained in this section describes the isolation and correction of problems at the circuit board and mechanical assembly level only. For information regarding troubleshooting at the component level, contact Kaye Instruments' Customer Service Department in Bedford, Mass.

The information contained in Section 5 consists of a Troubleshooting Diagnostic Table and a series of test procedures. The Troubleshooting Diagnostic Table is used as the starting point for the isolation and correction of Digistrip III operating problems. The leftmost column of the table lists the symptoms of a variety of problems; the middle column lists the most common sources of each problem. The rightmost column provides a test procedure reference for each symptom. To isolate a problem, first locate the symptom in the leftmost column, then read across the table to determine the possible sources and appropriate test procedure reference. As the test procedure is carried out, the source of the problem likely will be revealed and appropriate corrective action recommended.

5.2 TROUBLESHOOTING DIAGNOSTIC TABLE

Problem	Possible Sources of Problem	Test Procedure (Section Reference)
Printhead Will Not Move	-Platen -Carriage Motor -Print Control Board -Power Supply	5.3.1
Printhead Moves to One Side and Stops	-Print Control Board -Power Supply -Data Acquisition Board	5.3.2
Printhead Moves Back and Forth Continuously	-Printhead -Print Control Board	5.3.3
Printhead Tears Paper	-Platen -Print Control Board	5.3.4
Printout Appears Backward	-Printer Assembly -Print Control Board	5.3.5
Printout is Missing Parts of Lines and/or Contains Incorrect Characters	-Print Control Board -Timing Fence -Data Acquisition Board	5.3.6
Printout is Missing Parts of Characters	-Printhead -Print Control Board	5.3.7
Printhead Moves But Paper Does Not Advance	-Paper Take-up Motor -Print Control Board	5.3.8
Instrument is Completely Inoperative	-Power Supply -Data Acquisition Board -Print Control Board	5.3.9
One or More Segments of Display Panel are Inoperative	-Data Acquisition Board -Digital Display Board	5.3.10

5.2 TROUBLESHOOTING DIAGNOSTIC TABLE (continued)

Problem	Possible Sources of Problem	Test Procedure (Section Reference)
Main Fuse Blows Repeatedly	-Carriage Motor -Power Supply	5.3.11
Instrument Power Fails Intermittently	-Power Supply -Data Acquisition Board	5.3.12
One or More Keyboard Keys are Inoperative	-Control Panel -Data Acquisition Board	5.3.13
Instrument Loses or Gains Time and/or Loses Program Information	-Data Acquisition Board -Batteries -Power Supply	5.3.14
All Channels Read OVERRANGE or OPEN	-Analog Board -Channel Access Board	5.3.15
Some Channels Read OVERRANGE or OPEN	-Channel Access Baord -Analog Board	5.3.16
Data Values Drift	-Channel Access Board -Analog Board	5.3.17
Data Values are Incorrect	-Calibration -Analog Board -Channel Access Board -Data Acquisition Board	5.3.18
Even and/or Odd Relays Do Not Operate Properly	-Print Control Board -Data Acquisition Board	5.3.19
Input and/or Output Ports Do Not Operate Properly	-Data Acquisition Board -Print Control Board	5.3.20
Printhead Moves Erratically and/or Squeaks	-Printhead Drive Assembly	5.3.21

5.3 Test Procedures

5.3.1 Printhead Will Not Move

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- Allen Wrench Set
- Volt/Ohm Meter

Test Procedure

1. If the printhead appears to be jammed against the platen, turn the power switch OFF, refer to Section 5.3.4, and check out the printhead-to-platen clearance at the point where the printhead is located. If necessary, adjust, straighten or replace the platen. Once the printhead-to-platen clearance is properly adjusted, if the printhead still will not move, proceed to step 2 below.

2. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

3. Remove the paper from the printer.

4. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis--rear edge first.

5. Remove the mounting screws from the front of the black metal paper guide and lift the guide off the chassis.

   Note: For some early production Digistrip III units, it is necessary to remove the data acquisition board (left side of chassis) and the print control board (right side of chassis) to gain access to the paper guide mounting screws. For instructions on the removal of these boards, see Sections 3.5 and 3.4.

6. Examine the chassis interior and locate the carriage motor. This motor is mounted in the upper right front corner of the chassis.

7. Disconnect the carriage motor power cable by unplugging its two-pin Molex connector. This connector is located in the lower right rear corner of the chassis.

8. Measure the resistance of the carriage motor by connecting the volt/ohm meter lead wires to the two male pins of the Molex connector. This measurement should be 25 to 30 ohms.

9. If the resistance measurement is less than 25 ohms, the carriage motor probably is defective and in need of replacement. For the carriage motor exchange procedure, see Section 3.8.

10. After checking out the carriage motor resistance, reconnect the two-pin Molex connector.

11. If the carriage motor resistance checks out OK, refer to Section 3.12 and check out the printhead drive assembly to make sure that the drive chain, drive pin, and drive gears are properly installed and adjusted.

12. Remove the black metal cover plate from the print control board (right side of chassis).

13. Reconnect the power cord, turn the power switch ON and use the volt/ohm meter to check for the prescribed voltages (as listed below) on the print control board.

Capacitor Identification	Capacitor Location on Print Control Board	Prescribed Voltage
C20	Upper Center Area	+5.0 VDC (±0.2)
C39	Right Center Area	-12.0 VDC (±1.2)
C40	Upper Right Corner	+12.0 VDC (±1.2)

14. If the prescribed voltages are within the specified limits, but the printhead still will not move, the print control board probably is defective and in need of replacement. For the print control board exchange procedure, see Section 3.4.

15. If the prescribed voltages are not present, the power supply probably is defective and in need of replacement. For the power supply exchange procedure, see Section 3.3.

16. Once the printhead malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.2 Printhead Moves to One Side and Stops

Test Equipment Required

- Volt/Ohm Meter
- Phillips Screwdriver
- Small Regular Screwdriver

Test Procedure

1. With the power cord connected to a line voltage outlet and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal plate covering the print control board (right side of chassis).

3. Locate the two test pins labeled J1; these pins are mounted in the lower center area of the print control board.

4. With the Digistrip's power switch still turned OFF, use a small screwdriver to short across test pins J1. When doing this, take precautions to assure that the screwdriver does not make electrical contact with any other points.

5. With test pins J1 shorted, turn the Digistrip's power switch ON. This action will cause the print control board to initiate the printout of a test pattern containing all possible characters.

6. If the test pattern prints out satisfactorily, proceed to step #8.

7. If the test pattern does not print out, the print control board probably is defective and should be exchanged. For the print control board exchange procedure, see Section 3.4.

8. If the test pattern prints out, remove the screwdriver from between test pins J1 and turn the Digistrip's power switch OFF.

9. Turn the power switch back ON and use the volt/ohm meter to check for the prescribed voltages (as listed below) on the print control board.

Capacitor Identification	Capacitor Location on Print Control Board	Prescribed Voltage
C20	Upper Center Area	+5.0 VDC (±0.2)
C39	Right Center Area	-12.0 VDC (±1.2)
C40	Upper Right Corner	+12.0 VDC (±1.2)

10. If the prescribed voltages are not present, the power supply probably is defective and in need of replacement. For the power supply exchange procedure, see Section 3.3.

11. If the prescribed voltages are present, the data acquisition board probably is defective and should be exchanged. For the data acquisition board exchange procedure, see Section 3.5.

12. Once the printhead malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.3 Printhead Moves Back and Forth Continuously

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver

Test Procedure

1. With the power cord connected to a line voltage outlet and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal plate covering the print control board (right side of chassis).

3. With the PROGRAM/RUN switch set in the PROGRAM position, turn the power switch ON. Under normal operating conditions, when the power switch is turned ON, the printhead moves across the page area one time and stops. If the printhead moves back and forth continually, proceed to step #4.

4. Locate potentiometer P2 which is mounted in the upper front corner of the print control board.

5. Using a small screwdriver, turn P2 clockwise until it starts making a clicking sound. This sound indicates the end of its adjustment range. Next, set P2 at the approximate center of its adjustment range by turning it counterclockwise eight revolutions. Once this center point is reached, attempt to stop the continual printhead movement by gradually turning P2 clockwise or counterclockwise a maximum of five revolutions from the center point.

   Note: For details on precision adjustment of the print control board, see Section 3.4.

6. If adjustment of P2 does not cause the printhead to stop moving, the print control board probably is defective and in need of replacement. For the print control board exchange procedure, see Section 3.4.

7. If adjustment of potentiometer P2 causes the printhead to stop its continual back and forth movement, a special test mode may be used to check for proper printer operation. This test mode is described below.

8. In preparation to conduct the special printer test, turn the Digistrip's power switch OFF, set the PROGRAM/RUN switch in the RUN position, and locate the two test pins labeled J1. These test pins are mounted in the lower center area of the print control board.

9. With the Digistrip's power switch turned OFF, use a small screwdriver to short across test pins J1. When doing this, take precautions to assure that the screwdriver does not make electrical contact with any other points.

10. With test pins J1 shorted, turn the Digistrip's power switch ON, then remove the screwdriver. This action will cause the print control board to initiate the printout of a test pattern containing all possible characters.

11. Once it has been determined that the printer is operating properly, the special test mode may be discontinued and the printer returned to normal operation by turning the power switch OFF, then back ON.

12. Once the printhead malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.4 Printhead Tears Paper

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- Allen Wrench Set
- Feeler Gauge
- Flashlight

Test Procedure

1. With the power cord connected to a line voltage outlet and the power switch turned OFF, open the Digistrip's front door and slide the instrument forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the paper from the printer.

3. While aiming a lighted flashlight at the printhead from above, examine the printhead from beneath the chassis and check for any protruding print hammers. These hammers resemble thin wires. If one or more hammers are protruding, the printhead probably is defective and in need of exchange. For the printhead exchange procedure, see Section 3.3.

4. If step #3 revealed no protruding hammers, momentarily turn the power switch ON. This action will cause the printhead to move to one end of the carriage and stop. When the printhead stops, turn the power switch OFF.

5. With the printhead positioned at one end of the carriage, use the feeler gauge to check the printhead-to-platen clearance. This clearance should be 0.015 inches. If the clearance is not 0.015 inches, adjust the platen position to provide the proper clearance at that end of the carriage.

   Note: When checking and adjusting the platen position, always make sure that its printing face is vertically aligned.

6. After checking and adjusting the clearance at one end of the carriage, momentarily turn the power switch ON. This action will cause the printhead to move to the other end of the carriage. One the printhead stops in its new position, turn the power switch OFF.

7. Check and, if necessary, adjust the printhead-to-platen clearance at this end of the carriage to be 0.015 inches.

8. Using the power switch, move the printhead back and forth again and double check the printhead-to-platen clearance at both ends of the carriage.

9. Check out the printing face of the platen for cleanliness and smoothness. If this face is dirty or rough, remove the platen from the instrument, rub down the printing face with crocus cloth or fine steel wool, and replace the platen.

10. After carrying out steps #1-9 above, reinstall the paper into the instrument and check out the printhead for proper operation.

11. If the printhead continues to tear the paper, check for a warp in the platen. To do this, turn the power switch ON, then, as the printhead moves across the carriage, turn the power switch off. This will cause the printhead to stop in the middle of the carriage. Then use the feeler gauge to check the printhead-to-platen clearance at that point. If the clearance is not 0.015 inches, the platen probably is warped and in need of replacement.

12. If the printhead continues to tear the paper after all of the above actions have been taken, the print control board probably is defective and in need of exchange. For the print control board exchange procedure, see Section 3.4.

13. Once the printhead malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.5 Printout Appears Backward

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Allen Wrench Set
- 1/4" Nut Driver

Test Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the paper from the printer.

3. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis--rear edge first.

4. Remove the mounting screws from the front of the black metal paper guide and lift the guide off the chassis.

   Note: For some early production Digistrip III units, it is necessary to remove the data acquisition board (left side of chassis) and print control board (right side of chassis) to gain access to the paper guide mounting screws. For instructions on the removal of these boards, see Section 3.5 and 3.4.

5. With the paper guide and upper paper tray removed, refer to Sections 3.9 and 3.12 and check out the printer assembly to make sure that the drive chain, drive pin, drive gears and optical timing fence are properly installed and adjusted. If any adjustments are needed, they should be made at this time.

6. After checking out the printer assembly, connect the instrument's power cord to a line voltage outlet, turn the power switch ON, and check out the printer for proper operation.

7. If, after checking out the printer assembly, the printout still appears backward, refer to Section 3.4 and carry out the print control board adjustment procedure.

8. If, after carrying out the print control board adjustment procedure, the printout still appears backward, the print control board probably is defective and in need of replacement. For the print control board exchange procedure, see Section 3.4.

9. Once the printer malfunction has been corrected, close up the instrument and resume normal monitoring operations.

5.3.6 Printout is Missing Parts of Lines and/or Contains Incorrect Characters

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Allen Wrench Set
- 1/4" Nut Driver

Test Procedure

1. With the power cord connected to a line voltage outlet and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal plate covering the print control board (right side of chassis).

3. Locate the two test pins labeled J1; these pins are mounted in the lower center area of the print control board.

4. With the Digistrip's power switch still turned OFF, use a small screwdriver to short across test pins J1. When doing this, take precautions to assure that the screwdriver does not make electrical contact with any other points.

5. With test pins J1 shorted, turn the Digistrip's power switch ON, then remove the screwdriver. This action will cause the print control board to initiate the printout of a test pattern containing all possible characters.

6. If the test pattern does not print out satisfactorily, either the print control board or the timing fence probably is defective and in need of replacement. For the print control board exchange procedure, see Section 3.4. For the timing fence exchange procedure, see Section 3.9.

7. If the test pattern does print out satisfactorily, the data acquisition board probably is defective and in need of exchange. For the data acquisition board exchange procedure, see Section 3.5.

8. Once the printer malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.7 Printout is Missing Parts of Characters

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Allen Wrench Set
- 1/4" Nut Driver
- Volt/Ohm Meter

Test Procedure

1. With the power cord connected to a line voltage outlet and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal plate covering the print control board (right side of chassis).

3. Using the volt/ohm meter, check the continuity of the seven print hammer fuses (fuses F1 through F7) located near the lower front corner of the print control board.

4. Replace any blown fuses with 1 amp Fast-Flo fuses.

5. After replacing all blown fuses, turn the Digistrip's power switch ON and check out the printer for proper operation. If the fuses blow again, the printhead probably is defective and in need of replacement. For the printhead exchange procedure, see Section 3.10.

6. If no blown fuses are found during the above checkout procedure, but information continues to be printed out with parts of characters missing, either the printhead or the print control board probably is defective and in need of replacement. For the printhead exchange procedure, see Section 3.10. For the print control board exchange procedure, see Section 3.4.

7. Once the printer malfunction has been corrected, close up the instrument and resume normal monitoring operations.

5.3.8 Printhead Moves But Paper Does Not Advance

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Allen Wrench Set
- 1/4" Nut Driver

Test Procedure

1. With the power cord connected to a line voltage outlet and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal plate covering the print control board (right side of chassis).

3. Using the volt/ohm meter, check the continuity of fuse F8 located near the upper front corner of the print control board.

4. If fuse F8 is blown, replace it with a 1 amp Slo-Blo fuse. After replacing the blown fuse, turn the Digistrip's power switch ON and check to see if the printer is operating normally. If fuse F8 blows again, the paper feed motor probably is defective and in need of replacement. For the paper feed motor exchange procedure, see Section 3.11.

5. If the above check-out reveals that fuse F8 is not blown, check out the black-six-pin connector located at the back of the print control board. In order for the printer to work properly, the two parts of this connector must be tightly connected.

6. If both fuse F8 and the six-pin connector check out OK, either the print control board or the paper feed motor probably is defective and in need of exchange. For the print control board exchange procedure, see Section 3.4. For the paper feed motor exchange procedure, see Section 3.11.

7. Once the printer malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.9 Instrument Is Completely Inoperative

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Allen Wrench Set
- 1/4" Nut Driver
- Volt/Ohm Meter

Test Procedure

1. With the power cord disconnected and the power switch turned OFF, check the condition of the Digistrip's main fuse. This fuse is mounted on the instrument's back door. If the main fuse is blown, replace it with a 1.5 amp Slo-Blo fuse (0.75 amp Slo-Blo fuse for 230 VAC systems).

2. After replacement of a blown fuse, connect the power cord to a live voltage outlet, turn the power switch ON, and check out the instrument for normal operation (i.e. illumination of display panel, normal operation of printer, etc.). If the fuse blows again when the power switch is turned ON, the power supply probably is defective and in need of exchange. For the power supply exchange procedure, see Section 3.2.

3. If the main fuse checks out OK, but the instrument still remains inoperative when powered-up, turn the power switch OFF and proceed with step #4.

4. With the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

5. Remove the paper from the printer.

6. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis - rear edge first.

7. Locate the two Molex cable connectors on the left and right sides of the power supply. Check out these connectors to make sure that the two parts of each connector are properly aligned and tightly fitted together.

8. Remove the black metal plate covering the data acquisition board (left side of chassis).

9. Locate the blue coupling capacitor labeled C40; this capacitor is mounted near the lower rear corner of the data acquisition board.

10. Turn the Digistrip's power switch ON and measure the voltage across capacitor C40. To do this, connect the volt/ohm meter probe to the left side of C40 and connect the ground wire to the right side of C40. With the power ON, the voltage across C40 should be +5V (±0.2V).

11. If the +5V (±0.2V) reading is present across C40 and the Digistrip is still inoperative, the data acquisition board probably is defective and in need of exchange. For the data acquisition board exchange procedure, see Section 3.5.

12. If the +5V (±0.2V) reading is not present across C40, turn the power switch OFF and disconnect the bottom cable connector from the rear edge of the data acquisition board.

13. Remove the black metal cover plate from the print control board (right side of chassis).

14. Locate the capacitor labeled C20; this capacitor is mounted in the upper center area of the print control board.

15. Turn the Digistrip's power switch ON and measure the voltage across capacitor C20. To do this, connect the volt/ohm meter probe to the top of C20 and connect the ground wire to the bottom of C20. With the power ON, the voltage across C20 should be +5V (±0.2V).

16. If the +5V (±0.2V) reading is present across C20, and the Digistrip is still inoperative, the print control board probably is defective and in need of replacement. For the print control board exchange procedure, see Section 3.4.

17. If the +5V reading is not present across C20, the power supply probably is defective and in need of replacement. For the power exchange provedure, see Section 3.3.

18. Once the Digistrip's malfunction has been corrected, close up the instrument and resume normal monitoring operations.

5.3.10 One or More Segments of Display Panel are Inoperative

Test Equipment Required

- Phillips Head Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver

Test Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal cover from the data acquisition board (left side of chassis).

3. Locate the ribbon cable connector mounted in the upper front corner of the data acquisition board. Check out this connector to make sure that its two parts are properly aligned and tightly fitted together.

4. If the ribbon cable is properly connected and one or more segments of the front panel display still are inoperative, either the data acquisition board or the digital display board probably is defective and in need of exchange. For the data acquisition board exchange procedure, see Section 3.5. For the digital display board exchange procedure, see Section 3.13.

5. Once the display panel malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.11 Main Fuse Blows Repeatedly

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Allen Wrench Set
- Volt/Ohm Meter

Test Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the paper from the printer.

3. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis--rear edge first.

4. Locate the carriage motor power cable and unplug its two-pin Molex connector. This connector is located in the lower right rear corner of the chassis.

5. Using the volt/ohm meter, measure the resistance across the male pins of the connector segment attached to the carriage motor. The resistance reading should be 25 to 30 ohms.

6. If the resistance reading is below 25 ohms, the carriage motor probably is defective and in need of exchange. For the carriage motor exchange procedure, see Section 3.8.

7. If the resistance reading is satisfactory, the power supply probably is defective and in need of exchange. For the power supply exchange procedure, see Section 3.3.

8. After carrying out the steps listed above, reconnect the two-pin Molex connector, install a new 1.5 amp Slo-Blow fuse, connect the power cord to a line voltage outlet, turn the power switch ON and check out the instrument for proper operation.

9. Once the Digistrip's malfunction has been corrected, close up the instrument and resume normal monitoring operations.

5.3.12 Instrument Power Fails Intermittently

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- Allen Wrench Set
- Volt/Ohm Meter

Test Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the paper from the printer.

3. Remove the mounting screws from the front edge of the upper paper tray and lift the tray off the chassis--rear edge first.

4. Locate the power supply and make the power supply adjustment according to the procedure described in Section 3.2.

5. With the power supply properly adjusted and the power switch turned OFF, remove the black metal plate covering the data acquisition board (left side of chassis).

5. Locate the blue coupling capacitor labeled C40; this capacitor is mounted near the lower rear corner of the data acquisition board.

6. Turn the Digistrip's power switch ON and measure the voltage across the capacitor C40. To do this, connect the volt/ohm meter probe to the left side of C40 and connect the ground wire to the right side of C40. With the power ON, the voltage across C40 should be +5V (±0.2V)

7. If the +5V (±0.2V) reading is irregular, or outside of the prescribed range, the power supply probably is defective and in need of replacement. For the power supply exchange procedure, see Section 3.3.

8. If the problem persists once a properly operating power supply is installed, the data acquisition board probably is defective and in need of replacement. For the data acquisition board exchange procedure, see Section 3.5.

9. Once the intermittent power failure problem has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.13 One or More Keyboard Keys Are Inoperative

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver

Test Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this take precautions to prevent the instrument from tipping forward.

2. Remove the black metal cover from the data acquisition board (left side of chassis).

3. Locate the ribbon cable connector mounted in the upper front corner of the data acquisition board. Check out this connector to make sure that its two parts are properly aligned and fitted together.

4. If the keyboard still malfunctions when the ribbon cable is properly connected, either the keyboard or the data acquisition board probably is defective and in need of replacement. For the keyboard exchange procedure, see Section 3.14. For the data acquisition board exchange procedure, see Section 3.5.

5. Once the keyboard malfunction has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.14 Instrument Loses or Gains Time and/or Loses Program Information

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver
- Volt/Ohm Meter

Test Procedure

1. With the power cord disconnected and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Remove the black metal cover from the data acquisition board (left side of chassis).

3. Locate the zener diode labeled Z1 on the data acquisition board; Z1 is mounted beneath the PROMs, near the lower front corner of the board.

4. Using the volt/ohm meter, check the voltage across Z1. This is done by connecting the meter's probe to the right side of Z1 and connecting the ground wire to the left side of Z1. The voltage across Z1 is representative of the voltage supplied from the power supply battery pack the CMOS memory chips. At all times, this voltage should be in the range +3.5V to +5.0V.

5. If the voltage across Z1 checks out OK, the data acquisition board probably is defective and in need of replacement. For the data acquisition board exchange procedure, see Section 3.5.

6. If the voltage across Z1 is not in the proper range, check out, and, if necessary, charge or replace the three rechargable AA batteries located on the power supply. Replacement batteries must be of the NI/CAD rechargable type.

7. If uncharged batteries are present in the power supply, these batteries should be allowed to charge in the instrument for at least 14 hours. The battery charging process continues whenever the Digistrip is connected to a line voltage supply and the power switch is turned ON.

8. If the problem persists after the above steps have been carried out, the power supply probably is defective and in need of replacement. For the power supply exchange procedure, see Section 3.3.

9. Once the problem has been corrected, close up the Digistrip and resume normal monitoring operations.

5.3.15 All Channels Read OVERRANGE or OPEN

This problem usually is caused by a program error, a defective analog board, or a defective channel access board. The tests for all of these defect conditions are included in the defective board isolation procedures described in Section 3.7.

5.3.16 Some Channels Read OVERRANGE or OPEN

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver

Test Procedure

1. With the Digistrip's power cord connected to a line voltage outlet, the power switch turned ON and the PROGRAM/RUN switch set in the PROGRAM position, initiate a printout of complete program information by pressing the LIST PROGRAM key.

2. Once the program printout is completed, review it carefully to make sure that all programmed instructions are accurate and complete.

3. With the instrument still set in the program mode, assign function 01 (the 65 mv DVM measuring scale) to all channels reading OVERRANGE or OPEN.

4. Short out the inputs of the problem channels by connecting jumper wires across each channel's input terminals.

5. Move the PROGRAM/RUN switch to the RUN position and call up the displayed value of each problem channel.

6. If the displayed values of the problem channels now read approximately 00.000mv, the software probably is operating properly and the problem probably is the result of program errors.

7. To correct any program errors, return the PROGRAM/RUN switch to the PROGRAM position and reprogram the desired operating instructions for the problem channels.

8. Next, move the PROGRAM/RUN switch to the RUN position and again check out the displayed values of these channels.

9. If the problem channels still read OVERRANGE or OPEN, initialize and reprogram the instrument.

10. After reprogramming the instrument, again check out the displayed values of the problem channels. If these channels still read OVERRANGE or OPEN, proceed to step #11.

11. Turn the power switch OFF, open the rear door and locate the analog board mounted inside the instrument.

12. Remove the black metal cover from the analog board and locate the neon bulb mounted in the lower left corner of the board.

13. Short out the neon bulb by connecting a jumper across its lead wires.

14. Turn the power switch ON, move the PROGRAM/RUN switch to the PROGRAM position, and assign function 01 to each problem channel.

15. Move the PROGRAM/RUN switch to the RUN position and call up the displayed value of each problem channel. If these channels now read approximately 00.000, the analog board is working correctly and the problem probably is the result of a defective channel access board. For the channel access board exchange procedure, see Section 3.7.

16. If the values displayed in step #15 (above) for the problem channels still read OVERRANGE or OPEN, the analog board probably is defective and in need of replacement. For the analog board exchange procedure, see Section 3.6.

17. Once the instrument malfunction has been corrected, reprogram the problem channels with the desired function numbers, disconnect the input terminal jumpers, close up the instrument, and resume normal monitoring operations.

5.3.17 Data Values Drift

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver

Test Procedure

1. Connect the Digistrip's power cord to a line voltage outlet, turn the power switch ON and set the PROGRAM/RUN switch in the PROGRAM position.

2. With the instrument set in the program mode, assign function 01 (the 65 mv DVM measuring range) to all problem channels.

3. Turn the power switch OFF.

4. Open the rear door and locate the analog board mounted inside the instrument.

5. Remove the black metal cover plate from the analog board and locate the neon bulb mounted in the lower left corner of the board.

6. Short out the neon bulb by connecting a jumper across its lead wires.

7. Turn the power switch ON and set the PROGRAM/RUN switch in the RUN position.

8. Call up the displayed value of each problem channel. If these values read approximately 00.000 mv and do not drift by more than 6μv, one or more channel access boards probably are defective and in need of replacement. For the channel access board exchange procedure, see Section 3.7.

9. If the values displayed for the problem channels in step #8 above are other than approximately 00.000, or if they are approximately 00.000, but drift by more than 6 mv, the analog board probably is defective and in need of replacement. For the analog board exchange procedure, see Section 3.6.

10. Once the malfunction has been corrected, reprogram the problem channels with the desired function numbers, disconnect the jumper from the neon bulb on the analog board, close up the instrument, and resume normal monitoring operations.

5.3.18 Data Values Are Incorrect

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver

Test Procedure

1. Connect the Digistrip's power cord to a line voltage outlet, turn the power switch ON and set the PROGRAM/RUN switch in the PROGRAM position.

2. Initiate a complete program printout by pressing the LIST PROGRAM key.

3. Once the program printout is completed, examine it carefully to make sure that all programmed instructions are accurate and complete. If any program changes are needed, they should be made at this time.

4. If the temperature readings or other output data values are incorrect by a few degrees, millivolts, etc., the instrument may be in need of calibration. For the calibration procedures, see Section 2.

5. If the output data values are totally incorrect, or if the outputs cannot be properly calibrated, the analog board probably is defective and in need of exchange. For the analog board exchange procedure, see Section 3.6.

6. If the output data values are still incorrect once a properly operating analog board is installed in the system, proceed to step #7 below.

7. With the instrument still set in the program mode, assign function 01 (the 65 mv DVM measuring scale) to several randomly selected test channels.

8. Turn the Digistrip's power switch OFF, open the rear door and locate the analog board mounted inside the instrument.

9. Remove the black metal cover plate from the analog board and locate the neon bulb mounted in the lower left corner of the board.

10. Short out the neon bulb by connecting a jumper across its lead wires.

11. Turn the power switch back ON and set the PROGRAM/RUN switch in the RUN position.

12. Call up the displayed value of each test channel to which function 01 is assigned. If the value of each channel is approximately 00.000 mv, one or more channel access boards probably is defective and in need of replacement. For the channel access board exchange procedure, see Section 3.7.

13. If the test channel values displayed in step #12 above are other than approximately 00.000 mv, the analog board probably is defective and in need of replacement. For the analog board exchange procedure, see Section 3.6.

14. If the problem of incorrect output values persists once properly operating channel access and analog boards are installed in the system, the data acquisition board probably is defective and in need of replacement. For the data acquisition board exchange procedure, see Section 3.5.

15. Once the system malfunction has been corrected, reprogram the desired function numbers into the test channels, disconnect the jumper from the neon bulb on the analog board, close up the instrument and resume normal monitoring operations.

5.3.19 Even and/or Odd Relays Do Not Operate Properly

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver

Test Procedure

1. Connect the Digistrip's power cord to a line voltage outlet, turn the power switch ON and set the PROGRAM/RUN switch in the PROGRAM position.

2. Check out the relay installation to make sure that it is properly set up and connected to the Digistrip.

3. Initiate a complete program printout by pressing the LIST PROGRAM key.

4. Once the program printout is completed, examine it carefully to make sure that all programmed instructions are accurate and complete. Pay particular attention to the programmed relay operating instructions and configuration numbers. If any program changes are needed, they should be made at this time.

5. Once the program has been checked out and corrected as needed, if the relays still do not work properly, the print control board probably is defective and in need of replacement. For the print control board exchange procedure, see Section 3.4.

6. If the relay malfunction persists once the above steps have been carried out, the data acquisition board probably is defective and in need of replacement. For the data acquisition board exchange procedure, see Section 3.5.

7. Once the relay malfunction has been corrected, close up the instrument and resume normal monitoring operations.

5.3.20 Input and/or Output Ports Do Not Operate Properly

Test Equipment Required

- Phillips Screwdriver
- Small Regular Screwdriver
- 1/4" Nut Driver

Test Procedure

1. With the power cord connected to a line voltage outlet and the power switch turned OFF, open the Digistrip's front door and slide the chassis forward on its rails. When doing this, take precautions to prevent the instrument from tipping forward.

2. Locate the baud rate selection jumper mounted on the data acquisition board (left side of chassis). This jumper is accessible through a cut-out in the black metal cover plate.

3. By appropriate positioning of the baud rate jumper, the data transmission rate of the Digistrip may be set at 150, 300, 600, 1200, or 2400 baud. In order to assure data transmission compatibility between the Digistrip and other equipment, make sure that the baud rate settings of the Digistrip and all peripheral devices are the same.

4. Check out all input and output connections on the back of the Digistrip and make sure that they are properly installed.

5. Turn the power switch ON, set the PROGRAM/RUN switch in the PROGRAM position and initiate a complete program printout by pressing the LIST PROGRAM key.

6. Once the program printout is completed, examine it carefully to make sure that all programmed instructions are accurate and complete. Pay particular attention to the configuration numbers. If any program changes are needed, they should be made at this time.

7. Set the PROGRAM/RUN switch in the RUN position and call up the display of data for several channels. If, after carrying out steps #1 through #6 above, the problem with the input and/or output ports persists, either the data acquisition board or the print control board probably is defective and in need of replacement. For the data acquisition board exchange procedure, see Section 3.5. For the print control board exchange procedure, see Section 3.4.

8. Once the system malfunction has been corrected, close up the instrument and resume normal monitoring operations.

5.3.21 Printhead Moves Erratically and/or Squeaks

Conditions causing the printhead to move erratically and/or squeak usually are the result of problems with the printhead drive assembly. For the printhead drive assembly checkout, adjustment and lubrication procedure, see Section 3.12.

Section 6 - Packing and Shipping

The carton in which each Digistrip III is shipped from the factory is designed to adequately protect the instrument from damage during transit. It is important that similar packaging be utilized whenever a Digistrip must be shipped. The following paragraphs outline proper packing and shipping procedures.

Boxes or crates used to transport a Digistrip should be constructed of double wall corrugated paper or wood. They should be six inches larger in each dimension than the instrument to allow room for packing material. Corrugated boxes should be secured with reinforced packing tape.

The Digistrip should be placed in the box with corner blocks of high density foam or multilayered corrugated paper to prevent it from shifting during transit. Failure to do this will allow the instrument to shift its position in the container, making it prone to damage from impact. To further protect the Digistrip during shipping, tape a square of cardboard over the front door window, and fill the space around the instrument with plastic foam "peanuts."

To expedite handling of the Digistrip by the receiver, attach a label to the top of the instrument indicating your company name and address, the destination, and a description of the instrument and any inclusions such as keys or manuals. If the Digistrip is being returned to Kaye Instruments for service, be sure to include the Return Authorization number obtained from Kaye's Customer Service Department.

If frequent shipments are anticipated, use of a reshippable container (Kaye Item # M0155) is recommended. This specially designed case has a custom formed interior designed to safely hold the instrument, its power cord, and user guides. It is suitable for air or motor freight transport.

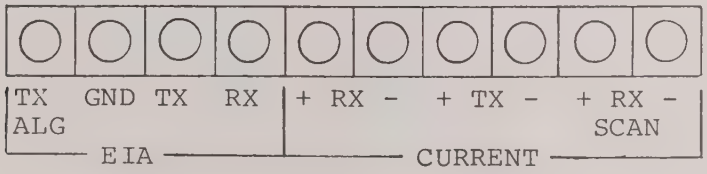
Section 7 - Serial Data Interfacing

7.1 General Information

The Digistrip III is capable of communicating in ASCII-encoded serial data with a variety of peripheral devices. These devices include computers, CRT terminals, cassette recorders, remote scanners, etc. Depending upon the application involved, serial data may be transmitted or received in either EIA RS-232C, or TTY-type 20 ma current loop format. When the current loop format is used, the Digistrip acts as a passive transmitting and receiving device.

A group of serial data connection terminals are mounted on the Digistrip's rear door panel. These terminals are shown in the figure below. EIA RS-232C terminals are provided for communication with a computer, or other peripheral devices. A special RS-232C terminal (labeled TX ALG) is provided for the continuous transmission of processed output data for a specified group of 16 source channels to a Model AO-16 Analog Output Module. TTY-type current loop terminals also are provided for communication with a computer or other peripheral devices. A special set of current loop terminals (labeled RX SCAN) are provided for the receipt of data from remote digital and analog scanners. The table on page 7-2 provides detailed information on the connections to be used for various types of serial data communication.

Serial Data Connection Terminals



Serial Data Interface Connections

Connect Digistrip III terminals to peripheral device terminals as indicated below:

Digistrip III Connection Terminals	Peripheral Device Connection Terminals: Computer Terminal (EIA)	CPU/ Modem (EIA)	RAMP/ Scanner (TTY)*	Current Loop (TTY) Device	RD-48 Relay Driver
TX ALG (EIA)	--	--	--	--	--
GND (EIA)	Pin 7	Pin 7	--	--	--
TX (EIA)	Pin 3	Pin 2	--	--	--
RX (EIA)	Pin 2	Pin 3	--	--	--
RX+ (TTY)	--	--	Pin 4	TX+	--
RX- (TTY)	--	--	Pin 12	TX-	--
TX+ (TTY)	--	--	--	RX+	RX+
TX- (TTY)	--	--	--	RX-	RX-
RX SCAN+ (TTY)	--	--	--	--	--
RX SCAN- (TTY)	--	--	--	--	--
ODD RELAY--COM	--	--	--	--	--
ODD RELAY--NC	--	--	--	--	--

*When connecting a RAMP/Scanner to a Digistrip III, make sure that a jumper is installed between Pins 3 and 13 on the connection cable.

Digistrip III Connection Terminals	Peripheral Device Connection Terminals: Cassette Program Loader	MFE-2500 Digital Recorder	AO-16 (Single Scanner)	AO-16 (Multiple Scanners)	FS-8/ DS-8 Scanners
TX ALG (EIA)	--	--	RX	--	--
GND (EIA)	GND	Pin 7	GND	--	--
TX (EIA)	RX	Pin 2	--	--	--
RX (EIA)	TX	Pin 3	--	--	--
RX+ (TTY)	--	--	--	--	--
RX- (TTY)	--	--	--	--	--
TX+ (TTY)	--	--	--	RX+	--
TX- (TTY)	--	--	--	RX-	--
RX SCAN+ (TTY)	--	--	--	--	TX+
RX SCAN- (TTY)	--	--	--	--	TX-
ODD RELAY--COM	--	--	--	--	RX+
ODD RELAY--NC	--	--	--	--	RX-

The baud rate of the Digistrip must be matched to that of the peripheral devices with which it is communicating. The baud rate of the special EIA analog output terminal (labeled TX ALG) and that of the special current loop remote scanner input terminal pair (labeled RX SCAN) are fixed at 1200. The baud rate of the other serial data terminals must be defined by appropriate setting of the baud rate jumper. This jumper is located near the left rear corner of the data acquisition board (left side of chassis). The baud rate jumper may be set for 150, 300, 600, 1200, or 2400 baud. Whenever the baud rate of the Digistrip is to be changed, it must be done when the instrument's power switch is turned OFF.

The Digistrip generates data in a line format suitable for use by its internal printer. Each line consists of 137 characters, followed by a carriage return and line feed command. Each character is made up of one start bit, seven data bits, one even parity bit, and one stop bit. The character transmission rate is equal to the baud rate divided by 10.

7.2 Serial Data Interface Options

The operating parameters of a Digistrip III are defined by programming Configuration Numbers 1, 2, 3, and 4. Details on Configuration Number programming are provided on pages 29-34 of the Digistrip III User's Guide. Many of the Digistrip's operating parameters relate to serial data interfacing. By appropriate specification of the Configuration Number digits, the user may select one or more of the following serial data interface options:

Serial Data Interface Options

- Remote Scanner Inputs
- Single Line Analog Data Outputs
- Verbatim Copy of Digistrip Printout
- User-Defined Serial Data Communication
- Program Offloading and Loading
- Serial Relay Outputs
- Printing Messages from a Computer

7.2.1 Remote Scanner Input

This option is used to enable the receipt of serial data inputs from one or more RAMP/Scanners, FS-8 Frequency Scanners, and/or DS-8 Digital Scanners. Its data transmission rate is fixed at 1200 baud. The Remote Scanner Input option is implemented by specifying digit 2 of Configuration Number 4 to be 4, 5, 6 or 7.

Note: When using a RAMP/Scanner with a Digistrip III, make sure that resistor R13 on the scanner's outguard power supply is a 330Ω, ½W resistor.

7.2.2 Single Line Analog Data Output

This option is used to enable the continuous high speed serial transmission of processed output data from a single group of 16 consecutive channels to an AO-16 Analog Output Module. Its data transmission rate is fixed at 1200 baud. The Single Line Analog Data Output option is implemented by the appropriate specification of digit 5 of Configuration Number 4.

7.2.3 Verbatim Copy of Digistrip Printout

This option is used to enable the transmission of a verbatim copy of all Digistrip printout information to a computer, CRT terminal, external printer, or data storage device. When using this option, the baud rate of the Digistrip must be set to match the baud rate of the peripheral device to which the printout information will be transmitted. The Verbatim Copy of Digistrip Printout option is implemented by specifying digit 4 of Configuration Number 3 to be 4. Whenever this option is enabled, the User-Defined Serial Data Communication option (Section 7.2.4), the Program Offloading and Loading option (Section 7.2.5), and the Serial Relay Output option (Section 7.2.6) are inoperative.

7.2.4 User-Defined Serial Data Communication

This option is used to enable user-defined serial data communication between a Digistrip III and a computer, CRT terminal, external printer, data storage device, etc. Whenever this option is utilized, the baud rate of the Digistrip must be set to match the baud rate of the peripheral devices with which it is to communicate.

When using the User-Defined Serial Data Communication option to transmit data from a Digistrip, the information on any combination of lines may be selected for transmission. The lines to be transmitted are specified by digits 1, 2 and 3 of Configuration Number 3. The data transmissions may be programmed to start upon one or more of the following occurrences:

- External Transmission (Serial Time) Interval Time-Out
- Accumulation Interval Time-Out
- Alarm Occurrence
- Contact Closure Input
- Command from a Computer

Transmission of data at the end of the external transmission interval, the end of the accumulation interval, or upon an alarm occurrence is enabled by the appropriate specification of Digit 5 of Configuration Number 3.

Transmission of data in response to an external contact closure is enabled by specifying digit 3 of Configuration Number 4 to be 2, 3, 6 or 7.

Transmission of data in response to a computer command is enabled by specifying digit 2 of Configuration Number 4 to be 1, 3, 5 or 7, and digit 3 of Configuration Number 4 to be 2, 3, 6 or 7. To initiate the transmission, the computer sends an ASCII DC2 (↑R) character. When enabled as described above, the DC2 command has the same effect as an external contact closure input.

By appropriate specification of digit 4 of Configuration Number 3, the transmitted data may be provided with or without channel numbers. Digit 6 of Configuration Number 3 may be used to specify the transmission of eight channels per line. If the transmission of eight channels per line is not specified, one channel per line will be transmitted when channel numbers are transmitted, and 16 channels per line will be transmitted when channel numbers are not transmitted. The figures on pages 7-7 and 7-8 show examples of the various formats in which channel data may be transmitted.

Data transmissions initiated by an alarm occurence may be printed out in the format described above, or in a single line alarm message format. The alarm message format is described on pages 63-65 of the Digistrip III User's Guide. Single line alarm message transmissions are enabled by specifying digit 4 of Configuration Number 4 to be 1, 3, 5, or 7.

Current time information is always transmitted as part of the first line of data when channel numbers are not transmitted. When channel numbers are transmitted, digit 4 of Configuration Number 3 may be specified to provide the time as the first line of each transmission.

Transmitted Data Printout Example
(8 Channels Per Line With Time)

```
15:34:40   28.0C*  28.0  0.0000  -0.001M   0.01M    0.0M   87.0F  0.002M
          -0.002M -0.002M  0.001M 100.00  10.000  10.000  20.000  200.00
15:34:50   28.0C*  28.0  0.0000   0.000M   0.01M    0.0M   87.0F  0.003M
           0.000M -0.002M  0.002M 100.00  10.000  10.000  20.000  200.00
15:35:00   28.0C*  28.0  -0.000   0.000M   0.01M    0.0M   87.0F  0.003M
          -0.001M -0.002M  0.002M 100.00  10.000  10.000  20.000  200.00
```

Transmitted Date Printout Example
(8 Channels Per Line With Channel Numbers)

```
601   28.1C*602   28.1  603 -0.000  604  0.000M 605   0.00M 606    0.1M 607   87.2F 608  0.002M
609 -0.001M 610 -0.003M 611  0.002M 612 100.00  613 10.000  614 10.000  615 20.000  616 200.00
601   28.1C*602   28.1  603 -0.000  604 -0.001M 605   0.00M 606    0.1M 607   87.2F 608  0.002M
609 -0.001M 610 -0.004M 611  0.003M 612 100.00  613 10.000  614 10.000  615 20.000  616 200.00
```

Transmitted Data Printout Example
(8 Channels Per Line With Time and Channel Numbers)

```
14:45:40
601   27.9C*602   27.9  603 -0.000  604 -0.001M 605   0.00M 606    0.0M 607   86.8F 608  0.002M
609 -0.002M 610 -0.003M 611  0.002M 612 100.00  613 10.000  614 10.000  615 20.000  616 200.00
14:45:50
601   27.9C*602   27.9  603 -0.000  604  0.000M 605   0.00M 606    0.0M 607   86.8F 608  0.002M
609 -0.002M 610 -0.003M 611  0.001M 612 100.00  613 10.000  614 10.000  615 20.000  616 200.00
```

Transmitted Data Printout Example
(16 Channel Per Line With Time)

14:51:30	27.8C*	27.8	0.0002	0.001M	0.00M	0.0M	86.6F	0.003M	0.000M	-0.001M	0.003M	100.00	10.000	10.000	20.000	200.00
14:51:40	27.8C*	27.8	0.0000	0.000M	0.00M	0.0M	86.6F	0.003M	-0.001M	-0.002M	0.002M	100.00	10.000	10.000	20.000	200.00
14:51:50	27.8C*	27.8	0.0000	0.000M	0.01M	0.0M	86.6F	0.003M	-0.001M	-0.002M	0.002M	100.00	10.000	10.000	20.000	200.00
14:52:00	27.8C*	27.8	0.0000	0.000M	0.01M	0.0M	86.6F	0.002M	-0.002M	-0.003M	0.002M	100.00	10.000	10.000	20.000	200.00
14:52:10	27.8C*	27.8	0.0000	0.000M	0.01M	0.0M	86.6F	0.002M	-0.001M	-0.003M	0.002M	100.00	10.000	10.000	20.000	200.00
14:52:20	27.8C*	27.8	0.0000	0.000M	0.01M	0.0M	86.6F	0.002M	-0.001M	-0.002M	0.002M	100.00	10.000	10.000	20.000	200.00
14:52:30	27.8C*	27.8	-0.000	0.000M	0.00M	0.1M	86.6F	0.002M	-0.002M	-0.003M	0.002M	100.00	10.000	10.000	20.000	200.00
14:52:40	27.8C*	27.8	0.0000	0.000M	0.00M	0.0M	86.6F	0.002M	-0.001M	-0.002M	0.002M	100.00	10.000	10.000	20.000	200.00

Transmitted Data Printout Example
(One Channel Per Line With Time and Channel Numbers)

```
15:39:10
601   28.0C*
602   28.0
603 -0.000
604 -0.001M
605   0.01M
606    0.0M
607   87.0F
608  0.002M
609 -0.002M
610 -0.003M
611  0.002M
612 100.00
613 10.000
614 10.000
615 20.000
616 200.00
```

Interactive Data Transmission

As a special feature of the User-Defined Serial Data Communication option, the Digistrip III provides interactive data transmission capability. This capability allows for the synchronization of a Digistrip's data transmissions with the processing speed of a computer. When the interactive transmission feature is enabled, the Digistrip waits to transmit information until a DC3 (↑S)character is received from the computer. Each time a DC3 character is received, a single line of data is transmitted. Upon the receipt of a DC3 character, if no data is waiting to be transmitted, the Digistrip disregards the transmission command. The interactive data transmission feature is enabled by specifying digit 6 of Configuration Number 3 to be 1, 3, 5, or 7. Whenever the interactive data transmission feature is enabled, the computer may send an ABORT command at any time during a data transmission. This command terminates the transmission and resets the Digistrip's logic. The ABORT command is an ASCII DC4 (↑T) character.

Serial Transmission Start and End Messages

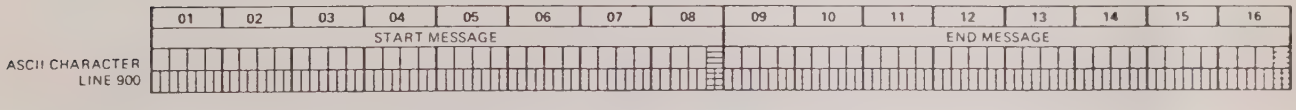
When Digistrip data outputs are to be transmitted to a computer, it sometimes is necessary to provide transmission Start and End messages as part of the serial data stream. This may be accomplished by programming encoded characters into two special memory locations. Each message may contain up to 31 encoded ASCII characters. These characters may be assigned in any combination desired. Each ASCII character is defined by programming a combination of two hexadecimal keyboard characters. The table below lists the keyboard character combinations available for programming, together with their ASCII equivalents.

Hexadecimal/ASCII Equivalents

00 NUL	20 SP	40 @	60 `
01 SOH	21 !	41 A	61 a
02 STX	22 "	42 B	62 b
03 ETX	23 #	43 C	63 c
04 EOT	24 $	44 D	64 d
05 ENQ	25 %	45 E	65 e
06 ACK	26 &	46 F	66 f
07 BEL	27 '	47 G	67 g
08 BS	28 (	48 H	68 h
09 HT	29)	49 I	69 i
0A LF	2A *	4A J	6A j
0B VT	2B +	4B K	6B k
0C FF	2C ,	4C L	6C l
0D CR	2D -	4D M	6D m
0E SO	2E .	4E N	6E n
0F SI	2F /	4F O	6F o
10 DLE	30 0	50 P	70 p
11 DC1 (X-ON)	31 1	51 Q	71 q
12 DC2 (TAPE)	32 2	52 R	72 r
13 DC3 (X-OFF)	33 3	53 S	73 s
14 DC4 (~~TAPE~~)	34 4	54 T	74 t
15 NAK	35 5	55 U	75 u
16 SYN	36 6	56 V	76 v
17 ETB	37 7	57 W	77 w
18 CAN	38 8	58 X	78 x
19 EM	39 9	59 Y	79 y
1A SUB	3A :	5A Z	7A z
1B ESC	3B ;	5B [	7B {
1C FS	3C <	5C \	7C |
1D GS	3D =	5D]	7D } (ALT MODE)
1E RS	3E >	5E ^ (↑)	7E ~
1F US	3F ?	5F — (←)	7F DEL (RUB OUT)

The serial transmission Start message is programmed into the secondary memory of header fields 901-908; the End message is programmed into the secondary memory of header fields 909-916. These messages are programmed in much the same manner as the alarm messages (see page 63 of the Digistrip III User's Guide). The figure below shows the programming format used.

Serial Transmission Start and End Message Programming Format



To program a Start message, first call up the secondary memory of header field 901. This memory location is accessed by pressing the HEADER key twice. Then, refer to the information above and program the desired message characters. The characters must be programmed in consecutive order, beginning with character position 1 of field 901. Each message must be terminated with a blank. To program an End message, call up the secondary memory of header field 909 and enter the desired message characters in a similar manner.

7.2.5 Program Offloading and Loading

This option provides for the offloading and loading of complete Digistrip III program information. When this option is implemented, programs may be offloaded to a Kaye Model CPL Cassette Program Loader, or a digital cassette recorder such as the MFE Model 2500. Cassette recorded programs may be loaded into a Digistrip III by use of the same equipment. To enable the offloading of program information from a Digistrip, digit 2 of Configuration Number 4 must be specified as 2, 3, 6 or 7. When using the Program Offloading and Loading option, the baud rate of the Digistrip must be set to match that of the recording device.

Details on the procedures used for offloading and loading programs with a Kaye Model CPL Cassette Program Loader are provided with the recorder. Procedures for offloading and loading programs with an MFE Model 2500 are available from Kaye Instruments upon request.

7.2.6 Serial Relay Output

This option is used whenever a Kaye Model RD-48 Relay Driver is to be operated in conjunction with a Digistrip III. Utilizing this option, the relay numbers for all active relays are transmitted continuously (except during data transmissions) whenever the Digistrip is operating in the Run Mode. When the Serial Relay Output option is used, the baud rate of the Digistrip must be matched to that of the Relay Driver. Serial Relay Outputs are implemented by specifying digit 3 of Configuration Number 3 to be 1, 3, 5 or 7. When either the Verbatim Copy of Digistrip Printout option (Section 7.2.3) or the User-Defined Serial Data Communication option (Section 7.2.4) is used in a system without a Relay Driver, digit 3 of Configuration Number 3 must be 0, 2, 4 or 6.

7.2.7 Printing Messages from a Computer

This option allows the Digistrip III to print out single line messages received from a computer. Each message may contain a maximum of 137 characters, termined with a carriage return and line feed command. The Printing Messages from a Computer option is implemented by specifying digit 3 of Configuration Number 2 to be 1, 3, 5 or 7. Before transmitting a message, the computer sends an ASCII DC1 (↑Q) character to test the availability of the Digistrip's printer. If the printer is available for use, the Digistrip responds with an ACK (↑F) character; if not, it responds with an NAK (↑U) character. The computer sends the message only when the Digistrip is ready to receive it.

DIGISTRIP III PROGRAMMING FORM

HEADERS, FUNCTIONS, CONFIGURATION NUMBERS AND TIME INTERVALS

	01	02	03	04	05	06	07	08	09	10	11	12	13	14	15	16
HEADER 900																
HEADER 100																
HEADER 200																
HEADER 300																
HEADER 400																
HEADER 500																
HEADER 600																
HEADER 700																
HEADER 800																
FUNCTION																
100																
200																
300																
400																
500																
600																
700																
800																

CONFIGURATION NUMBERS

CONFIGURATION NUMBER 1						
CONFIGURATION NUMBER 2						
CONFIGURATION NUMBER 3						
CONFIGURATION NUMBER 4						

TIME INTERVALS (MINUTES)

PRINT INTERVAL (P) _____

EXTERNAL TRANSMISSION INTERVAL (X) _____

MATH INTERVAL (M) _____

DIGISTRIP III PROGRAMMING FORM

FUNCTION PARAMETERS

USER-DEFINABLE LINEAR FUNCTIONS

FUNCTION NO	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29
INPUT 1																
INPUT 2																
OUTPUT 1																
OUTPUT 2																
UNITS ID																

FUNCTION NO	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
INPUT 1																
INPUT 2																
OUTPUT 1																
OUTPUT 2																
UNITS ID																

USER-DEFINABLE ACCUMULATION FUNCTIONS

FUNCTION NO.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61
ACCUM INTERVAL																
INPUT 1																
OUTPUT 1																
UNITS ID																

*INPUT 2																
*OUTPUT 2																

* Input 2 and Output 2 values are never defined for Accumulation Functions. Values may be assinged to these memory locations, however, in conjunction with Functions 96, 97 and 98.

GRAMMING FORM
RAMETERS

NEAR FUNCTIONS

21	22	23	24	25	26	27	28	29

37	38	39	40	41	42	43	44	45

IULATION FUNCTIONS

53	54	55	56	57	58	59	60	61

values are never defined
tions. Values may be
ory locations, however,
unctions 96, 97 and 98.